PhD Science® K–5 Curriculum Correlation to the Missouri Learning Standards in Science

Contents

K–2 Grade Band

Level K 1
Level 1 4
Level 2 7
K–2 Condensed Science and Engineering Practices, Progressions of Disciplinary Core Ideas, and Crosscutting Concepts 10

3–5 Grade Band

Level 3 26
Level 4 29
Level 5 32
3–5 Condensed Science and Engineering Practices, Progressions of Disciplinary Core Ideas, and Crosscutting Concepts 36

PhD Science® Correlation to the Missouri Learning Standards in Science: Level K

The *PhD Science* Level K curriculum aligns with the Kindergarten Missouri Learning Standards in Science. A detailed analysis of alignment follows.

Key: Module (M), Lesson (L)

Kindergarten Grade-Level Expectations

Physical Science

PS1 Matter and Its Interactions	**Aligned *PhD Science* Lessons**
K.PS1.A.1 Make qualitative observations of the physical properties of objects (i.e., size, shape, color, mass).	Level 2 M1 L1–9

PS2 Motion and Stability: Forces and Interactions	**Aligned *PhD Science* Lessons**
K.PS2.A.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.A.2 Describe ways to change the motion of an object (i.e., how to cause an object to go slower, go faster, go farther, change direction, stop).	Level K M2 L1–23

PS3 Energy	**Aligned *PhD Science* Lessons**
K.PS3.A.1 Make observations to determine the effect of sunlight on Earth's surface.	Level K M1 L8–16, 28–30
K.PS3.B.1 With prompting and support, 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

Life Science

LS1 From Molecules to Organisms: Structure and Processes	Aligned *PhD Science* Lessons
K.LS1.C.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

Earth and Space Science

ESS1 Earth's Place in the Universe	Aligned *PhD Science* Lessons
K.ESS1.B.1 Make observations during different seasons to relate the amount of daylight to the time of year.	Level 1 M4 L9–13, 23–25

ESS2 Earth's Systems	Aligned *PhD Science* Lessons
K.ESS2.D.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.ESS2.E.1 With prompting and support, construct an argument using evidence for how plants and animals (including but not limited to humans) can change the environment to meet their needs.	Level K M4 L1–10, 14–16, 26–28

ESS3 Earth and Human Activity	Aligned *PhD Science* Lessons
K.ESS3.A.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.C.1 Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.	Level K M4 L14–24, 26–28

Engineering, Technology, and the Application of Science

ETS1 Engineering Design	Aligned *PhD Science* Lessons
K.ETS1.A.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.ETS1.B.1 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.ETS1.C.1 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

PhD Science® Correlation to the Missouri Learning Standards in Science: Level 1

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

Key: Module (M), Lesson (L)

Grade 1 Grade-Level Expectations

Physical Science

PS3 Energy	**Aligned *PhD Science* Lessons**
1.PS3.A.1 Identify the source of energy that causes an increase in the temperature of an object (e.g., sun, stove, flame, light bulb).	Level K M1 L8–16, 28–30

PS4 Waves and Their Applications in Technologies for Information Transfer	**Aligned *PhD Science* Lessons**
1.PS4.A.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.C.1 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

Life Science

LS1 From Molecules to Organisms: Structure and Process	Aligned *PhD Science* Lessons
1.LS1.A.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

LS3 Heredity: Inheritance and Variation of Traits	Aligned *PhD Science* Lessons
1.LS3.A.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

Earth and Space Science

ESS1 Earth's Place in the Universe	Aligned *PhD Science* Lessons
1.ESS1.A.1 Describe the presence of the sun, moon, and stars in the sky over time.	Level 1 M4 L1–8, 14–25
1.ESS1.A.2 Use observations of the sun, moon, and stars to describe patterns that can be predicted.	Level 1 M4 L1–8, 14–25

ESS2 Earth's Systems	Aligned *PhD Science* Lessons
1.ESS2.D.1 Identify patterns indicating relationships between observed weather data and weather phenomena (e.g., temperature and types of precipitation, clouds and amounts of precipitation).	Level K M1 L1–11, 17–24, 28–30 Level K M4 L25

Engineering, Technology, and the Application of Science

ETS1 Engineering Design	**Aligned *PhD Science* Lessons**
1.ETS1.A.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
1.ETS1.B.1 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
1.ETS1.C.1 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

PhD Science® Correlation to the Missouri Learning Standards: Level 2

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

Key: Module (M), Lesson (L)

Grade 2 Grade-Level Expectations

Physical Science

PS1 Matter and Its Interactions	**Aligned *PhD Science* Lessons**
2.PS1.A.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.A.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

PS2 Motion and Stability: Forces and Interactions	**Aligned *PhD Science* Lessons**
2.PS2.A.1 Analyze data to determine how the motion of an object changed by an applied force or the mass of an object.	Level K M2 L1–23

PS4 Waves and Their Applications in Technologies for Information Transfer	**Aligned *PhD Science* Lessons**
2.PS4.A.1 Plan and conduct investigations to provide evidence that changes in vibration create change in sound.	Level 1 M3 L1–17, 26–29

Life Science

LS2 Ecosystems: Interactions, Energy, and Dynamics	**Aligned *PhD Science* Lessons**
2.LS2.A.1 Plan and conduct investigations on the growth of plants when growing conditions are altered (e.g., dark vs. light, water vs. no water).	Level 2 M3 L1–7, 25–29
2.LS2.A.2 Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.	Level 2 M3 L8–29

Earth and Space Science

ESS1 Earth's Place in the Universe	**Aligned *PhD Science* Lessons**
2.ESS1.C.1 Use information from several sources to provide evidence that Earth events can occur quickly or slowly.	Level 2 M2 L18–24

ESS2 Earth's Systems	**Aligned *PhD Science* Lessons**
2.ESS2.A.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.B.1 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.C.1 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

Engineering, Technology, and the Application of Science

ETS1 Engineering Design	**Aligned *PhD Science* Lessons**
2.ETS1.A.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
2.ETS1.B.1 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
2.ETS1.C.1 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

PhD Science® Correlation to the Missouri Learning Standards in Science: K–2 Condensed Science and Engineering Practices, Progressions of Disciplinary Core Ideas, and Crosscutting Concepts

The *PhD Science* K–2 curriculum aligns with the K–2 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: 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

Disciplinary Core Ideas: K–2 Progressions

Life Science

LS1 From Molecules to Organisms: Structures and Processes

LS1.A Structure and Function	**Aligned *PhD Science* Lessons**
All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water, and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow.	Level 1 M1 L1–15, 27–29

LS1.C Organization for Matter and Energy Flow in Organisms	**Aligned *PhD Science* Lessons**
All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow.	Level K M3 L4–16, 19–20, 22, 27–29

LS1.D Information Processing	**Aligned *PhD Science* Lessons**
Animals have body parts that capture and convey different kinds of information needed for growth and survival. Animals respond to these inputs with behaviors that help them survive. Plants also respond to some external inputs.	Level 1 M1 L16–21, 27–29

LS2 Ecosystems: Interactions, Energy, and Dynamics

LS2.A Interdependent Relationships in Ecosystems	**Aligned *PhD Science* Lessons**
Plants depend on water and light to grow.	Level 2 M3 L1–7, 25–29
Plants depend on animals for pollination or to move their seeds around.	Level 2 M3 L8–29

LS3 Heredity: Inheritance and Variation of Traits

LS3.A Inheritance of Traits	**Aligned *PhD Science* Lessons**
Young animals are very much, but not exactly, like their parents. Plants also are very much, but not exactly, like their parents.	Level 1 M1 L22–23, 26–29

LS3.B Variation of Traits	**Aligned *PhD Science* Lessons**
Individuals of the same kind of plant or animal are recognizable as similar but can also vary in many ways.	Level 1 M1 L22–23, 27–29

Earth and Space Science

ESS1 Earth's Place in the Universe

ESS1.A The Universe and Its Stars	**Aligned *PhD Science* Lessons**
Stars (other than the sun) are not observable in the sky during the day but are observed during the night.	Level 1 M4 L1–8, 14–25
Patterns of the motion of the sun, moon, and stars in the sky can be observed, described, and predicted.	Level 1 M4 L1–8, 14–25

ESS1.B Earth and the Solar System	**Aligned *PhD Science* Lessons**
Seasonal patterns of sunrise and sunset can be observed, described, and predicted.	Level 1 M4 L9–13, 23–25

ESS1.C The History of Planet Earth	**Aligned *PhD Science* Lessons**
Some events happen very quickly; others occur very slowly over a time period much longer than one can observe.	Level 2 M2 L18–24

ESS2 Earth's Systems

ESS2.A Earth Materials and Systems	Aligned *PhD Science* Lessons
Wind and water change the shape of the land.	Level 2 M2 L1–17, 20, 22–24

ESS2.B Plate Tectonics and Large-Scale System Interactions	Aligned *PhD Science* Lessons
Maps show where things are located. One can map the shapes and kinds of land and water in any area.	Level 2 M2 L1–2, 5–6 Level 2 M4 L1–6, 11–16, 20–21, 23–25

ESS2.C The Roles of Water in Earth's Surface Processes	Aligned *PhD Science* Lessons
Water is found in the ocean[s], rivers, lakes, and ponds. Water exists as solid ice and in liquid form.	Level 2 M4 L1–6, 16, 22–25

ESS2.D Weather and Climate	Aligned *PhD Science* Lessons
Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region at a particular time.	Level K M1 L1–11, 17–24, 28–30 Level K M4 L25
People measure these conditions to describe and record the weather and to notice patterns over time.	Level K M1 L1–11, 17–24, 28–30 Level K M4 L25

ESS2.E Biogeology	Aligned *PhD Science* Lessons
Plants and animals can change their environment.	Level K M4 L1–10, 14–16, 26–28

ESS3 Earth and Human Activity

ESS3.A Natural Resources	Aligned *PhD Science* Lessons
Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do.	Level K M3 L1–3, 9–29 Level K M4 L1–5, 8–9, 11–16

ESS3.C Human Impacts on Earth Systems	Aligned *PhD Science* Lessons
Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things.	Level K M4 L11–24, 26–28

Physical Science

PS1 Matter and Its Interactions

PS1.A Structure and Properties of Matter	**Aligned *PhD Science* Lessons**
Matter can be described and classified by its observable properties.	Level 2 M1 L1–16, 19, 23, 29–31 Level 2 M2 L3–4, 14–17
Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature.	Level 2 M1 L1–16, 19, 23, 29–31 Level 2 M2 L3–4, 14–17
Different properties are suited to different purposes.	Level 2 M1 L20–31

PS2 Motion and Stability: Forces and Interactions

PS2.A Forces and Motion	**Aligned *PhD Science* Lessons**
Pushes and pulls can have different strengths and directions.	Level K M2 L7–23
Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it.	Level K M2 L1–23

PS2.B Types of Interactions	**Aligned *PhD Science* Lessons**
When objects touch or collide, they push on one another and can change motion.	Level K M2 L13–23

PS3: Energy

PS3.A Definitions of Energy	**Aligned *PhD Science* Lessons**
Energy sources that increase the temperature of objects (e.g., sun, stove, flame, light bulb, oven).	Level K M1 L8–16, 28–30
The sun is the primary source of Energy on Earth.	Level 5 M2 L6–7, 15–19, 24–26

PS3.B Conservation of Energy and Energy Transfer	**Aligned *PhD Science* Lessons**
Sunlight warms Earth's surface.	Level K M1 L8–16, 28–30

PS3.C Relationship Between Energy and Forces	**Aligned *PhD Science* Lessons**
A bigger push or pull makes things go faster.	Level K M2 L7–9, 21–23

PS4: Waves and Their Applications in Technologies for Information Transfer

PS4.A Wave Properties	**Aligned *PhD Science* Lessons**
Sound can make matter vibrate. and vibrating matter can make sound.	Level 1 M3 L1–17, 26–29

PS4.B Electromagnetic Radiation	**Aligned *PhD Science* Lessons**
Objects can be seen only when light is available to illuminate them. Some objects give off their own light.	Level 1 M2 L1–9, 21–23
Some materials allow light to pass through them, others allow only some light through, and others block all the light and create a dark shadow on any surface beyond them, where the light cannot reach. Mirrors can be used to redirect a light beam.	Level 1 M2 L1–3, 10–23

PS4.C Information Technologies and Instrumentation	**Aligned *PhD Science* Lessons**
People also use a variety of devices to communicate (send and receive information) over long distances.	Level 1 M3 L18–29

Engineering, Technology, and the Applications of Science

ETS1: Engineering Design

ETS1.A Defining and Delimiting an Engineering Problem	**Aligned *PhD Science* Lessons**
A situation that people want to change or create can be approached as a problem to be solved through engineering. Such problems may have many acceptable solutions.	Level K M1 L4–7, 12–16 Level K M2 L17–20 Level 1 M1 L11–15 Level 2 M1 L24–28 Level 2 M2 L8–12
Asking questions, making observations, and gathering information are helpful in thinking about problems.	Level K M1 L12–16 Level 1 M1 L11–15 Level 2 M1 L24–28
Before beginning to design a solution, it is important to clearly understand the problem.	Level K M1 L12–16 Level 1 M1 L11–15 Level 2 M1 L24–28

ETS1.B Developing Possible Solutions	**Aligned *PhD Science* Lessons**
Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.	Level K M2 L17–20 Level K M4 L20–24 Level 1 M3 L21–25 Level 2 M3 L14–18

ETS1.C Optimizing the Design Solution	**Aligned *PhD Science* Lessons**
Because there is always more than one possible solution to a problem, it is useful to compare and test designs.	Level K M4 L20–24 Level 1 M3 L21–25 Level 2 M2 L8–12, 14–17

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 Missouri Learning Standards in Science: Level 3

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

Key: Module (M), Lesson (L)

Grade 3 Grade-Level Expectations

Physical Science

PS1 Matter and Its Interactions	**Aligned *PhD Science* Lessons**
3.PS1.A.1 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
3.PS1.B.1 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

PS2 Motion and Stability: Forces and Interactions	**Aligned *PhD Science* Lessons**
3.PS2.B.1 Plan and conduct investigations to determine the cause and effect relationship of electric or magnetic interactions between two objects not in contact with each other.	Level 3 M4 L19–21, 28–30

Life Science

LS1 From Molecules to Organisms: Structures and Processes	Aligned *PhD Science* Lessons
3.LS1.B.1 Develop a model to compare and contrast observations on the life cycle of different plants and animals.	Level 3 M3 L7–8, 23–28

LS3 Heredity: Inheritance and Variation of Traits	Aligned *PhD Science* Lessons
3.LS3.A.1 Construct scientific arguments to support claims that some characteristics of organisms are inherited from parents and some are influenced by the environment.	Level 3 M3 L9–13, 19–20, 26–28
3.LS3.B.1 Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving and finding mates.	Level 3 M3 L21–28
3.LS3.C.1 Construct an argument with evidence that in a particular ecosystem some organisms—based on structural adaptations or behaviors—can survive well, some survive less well, and some cannot [survive].	Level 3 M2 L1–2, 9–12, 16–19, 22–28
3.LS3.D.1 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

Earth and Space Science

ESS2 Earth's Systems	**Aligned *PhD Science* Lessons**
3.ESS2.D.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.D.2 Obtain and combine information to describe climates in different regions of the world.	Level 3 M1 L11–15, 27–29

ESS3 Earth and Human Activity	**Aligned *PhD Science* Lessons**
3.ESS3.B.1 Make a claim about the merit of an existing design solution that reduces the impacts of a weather-related hazard.	Level 3 M1 L1–3, 16–29

Engineering, Technology, and the Application of Science

ETS1 Engineering Design	**Aligned *PhD Science* Lessons**
3.ETS1.A.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.ETS1.B.1 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.ETS1.C.1 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

PhD Science® Correlation to the Missouri Learning Standards in Science: Level 4

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

Key: Module (M), Lesson (L)

Grade 4 Grade-Level Expectations

Physical Science

PS2 Motion and Stability: Forces and Interactions	**Aligned *PhD Science* Lessons**
4.PS2.A.1 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
4.PS2.A.2 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
4.PS2.B.1 Plan and conduct a fair test to compare and contrast the forces (measured by a spring scale in Newtons) required to overcome friction when an object moves over different surfaces (i.e., rough/smooth).	Level 3 M4 L15–17
4.PS2.B.2 Predict how changes in either the amount of force applied to an object or the mass of the object affects the motion (speed and direction) of the object.	Level 3 M4 L10–18, 28–30

PS3 Energy	Aligned *PhD Science* Lessons
4.PS3.A.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.B.1 Provide evidence to construct an explanation of an energy transformation(e.g., temperature change, light, sound, motion, and magnetic effects).	Level 4 M2 L1–5, 10–11, 24–26
4.PS3.B.2 Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.	Level 4 M2 L12–26
4.PS3.C.1 Use models to explain that simple machines change the amount of effort force and/or direction of force.	Level 3 M4 L10–14

PS4 Waves and Their Applications in Technologies for Information Transfer	Aligned *PhD Science* Lessons
4.PS4.A.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

Life Science

LS1 From Molecules to Organisms: Structures and Processes	Aligned *PhD Science* Lessons
4.LS1.A.1 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and plant reproduction.	Level 4 M3 L1–6, 20, 26–31
4.LS1.D.1 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 and Space Science

ESS1 Earth's Place in the Universe	Aligned *PhD Science* Lessons
4.ESS1.C.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

ESS2 Earth's Systems	Aligned *PhD Science* Lessons
4.ESS2.A.1 Plan and conduct scientific investigations or simulations to provide evidence how natural processes (e.g., weathering and erosion) shape Earth's surfaces.	Level 4 M1 L6–11, 25–27
4.ESS2.B.1 Analyze and interpret data from maps to describe patterns of Earth's features.	Level 4 M1 L18–20, 25–27

ESS3 Earth and Human Activity	Aligned *PhD Science* Lessons
4.ESS3.A.1 Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.	Level 4 M1 L12–17, 25–27

Engineering, Technology, and the Application of Science

ETS1 Engineering Design	Aligned *PhD Science* Lessons
4.ETS1.A.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
4.ETS1.B.1 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
4.ETS1.C.1 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

PhD Science® Correlation to the Missouri Learning Standards in Science: Level 5

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

Key: Module (M), Lesson (L)

Grade 5 Grade-Level Expectations

Physical Science

PS1 Matter and Its Interactions	**Aligned *PhD Science* Lessons**
5.PS1.A.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.A.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.B.1 Plan and conduct investigations to separate the components of a mixture/solution by their physical properties (i.e., sorting, filtration, magnets, screening).	Level 5 M1 L1–4, 11–17, 23–26
5.PS1.B.2 Conduct an investigation to determine whether the combining of two or more substances results in new substances.	Level 5 M1 L1–2, 13–26

PS2 Motion and Stability: Forces and Interactions	**Aligned *PhD Science* Lessons**
5.PS2.B.1 Support an argument that the gravitational force exerted by Earth on objects is directed toward the planet's center.	Level 5 M4 L3–4, 24–26

PS3 Energy	Aligned *PhD Science* Lessons
5.PS3.D.1 Use models to describe that energy stored in food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.	Level 5 M2 L15–19, 24–26

PS4 Waves and Their Applications in Technologies for Information Transfer	Aligned *PhD Science* Lessons
5.PS4.A.1 Develop a model to describe that objects can be seen only when light is reflected off them or when they produce their own light.	Level 4 M4 L1–17, 25–27

Life Science

LS1 From Molecules to Organisms: Structures and Processes	Aligned *PhD Science* Lessons
5.LS1.A.1 Compare and contrast the major organs/organ systems that perform similar functions for animals belonging to different vertebrate classes.	The *PhD Science* K–5 curriculum does not cover this topic.
5.LS1.C.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

LS2 Ecosystems: Interactions, Energy, and Dynamics	Aligned *PhD Science* Lessons
5.LS2.B.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 and Space Science

ESS1 Earth's Place in the Universe	**Aligned *PhD Science* Lessons**
5.ESS1.A.1 Support an argument that relative distances from Earth affects the apparent brightness of the sun compared to other stars.	Level 5 M4 L18–19, 24–26
5.ESS1.B.1 Make observations during different seasons to relate the amount of daylight to the time of year.	Level 5 M4 L1–2, 5–17, 20–26
5.ESS1.B.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

ESS2 Earth's Systems	**Aligned *PhD Science* Lessons**
5.ESS2.A.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.C.1 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

ESS3 Earth and Human Activity	**Aligned *PhD Science* Lessons**
5.ESS3.C.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

Engineering, Technology, and the Application of Science

ETS1 Engineering Design	Aligned *PhD Science* Lessons
5.ETS1.A.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
5.ETS1.B.1 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
5.ETS1.C.1 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

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 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