PhD SCIENCE® TIPS FOR FAMILIES

Overview for Families

What is *PhD Science*?

PhD Science® is a knowledge-building, phenomenon-driven curriculum. Each year comprises four units of study called modules. Each module provides students with a real-world context for their learning by focusing on an observable event that can be explained or predicted: the anchor phenomenon. Students explore these compelling phenomena through observing, questioning, modeling, and investigating. Woven throughout each module is a coherent storyline of science concepts that helps students make sense of the phenomena they are exploring.

What will my student do in class?

Students will be working, thinking, and experimenting just like real scientists. Science will involve hands-on investigations that allow students to develop a deep understanding of science concepts. As students uncover information about the anchor phenomenon, they will ask questions, find evidence, generate new ideas, and devise solutions.

Throughout each module, the questions students generate about the anchor phenomenon will be recorded on the *driving question board*—a chart the class will use to organize questions and guide student learning. The class also creates an anchor model and chart to visually express students' ideas. These tools help students see how different concepts fit together and how understanding of the phenomenon is deepening.

Each module offers opportunities for students to use the engineering design process, apply what they have learned to solve real-world problems, and present their ideas. For example, in a module on matter, students use their knowledge of materials and the properties of materials to design a shelter that protects from rain.

Discussion and debate will be part of many lessons, as students will make claims, defend them with evidence, and ask questions about the claims of their classmates. At the end of each module, students will participate in a Socratic Seminar that stimulates discussion. During the seminar, students respond to fundamental questions about the anchor phenomenon and broader scientific concepts by thinking critically and applying their learning from the module.

What will be different?

PhD Science lessons are designed to allow students to drive their own learning. Students uncover key concepts by actively engaging in science and engineering practices. In class, they read high-quality, age-appropriate texts that spark curiosity, introduce phenomena, and support the development of scientific understandings. Along the way, students document their learning in a Science Logbook that allows them to review and reflect on how they built their knowledge.

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How is science connected to other disciplines?

All *PhD Science* modules make connections across science fields and academic disciplines. The curriculum highlights connections to math, literacy, and social studies so students can practice approaching real-world tasks from an interdisciplinary perspective. For example, in a module on biomes, students practice math skills while comparing weather data. Students also connect their new knowledge to geography as they compare the plants and animals that live in biomes across the globe. In addition to cross-curricular connections, all modules include lessons devoted to the application of concepts. In these lessons, students apply science and engineering practices to solve an authentic problem.

How can I help?

With each module, you will receive a Family Tip Sheet that outlines the module concepts and includes ideas on how you can support your student at home. The goal of these suggestions is to help students see science everywhere—not just at school. Talking about science, watching science videos, or visiting a museum, park, or zoo are all ways to support your student's learning.

Is there homework?

PhD Science modules have optional, informal homework assignments to reinforce learning and connect students' understandings to their everyday lives. These assignments often include ideas to discuss with family members or questions that prompt a simple exploration. When applicable, students are encouraged to share their work with the class.

How are students assessed?

Student learning is assessed in informal and formal ways. Throughout each module, students will be informally assessed through questions and classwork. Toward the end of each module, students apply their new knowledge in a science or engineering challenge, an End-of-Module assessment, and the Socratic Seminar, all of which allow for formal evaluation of learning. The balance of ongoing and cumulative assessment allows instruction to be adjusted throughout the module to ensure that students are progressing.

What will my student study in Level 2?

Module	Title	Anchor Phenomenon
1	Matter	Birds Building Nests
2	Earth Changes	Transformation of Surtsey
3	Plants	Plant Recovery Around Mount St. Helens
4	Biomes	Environments On and Below Mount Everest

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Level 2 Module 1: Matter

CONTENT OVERVIEW

ANCHOR PHENOMENON: Birds Building Nests

Essential Question: Why do different kinds of birds use certain materials to build their nests?

By studying the materials that birds use to build their nests, we learn that the properties of matter and the ways matter can change make materials suited to specific purposes.

CONCEPT 1: Properties of Matter

Focus Question: How can we describe and classify matter?

Investigating different objects and materials helps us identify different properties of matter and classify those objects and materials.

CONCEPT 2: Matter Can Change

Focus Question: How can matter change?

Observing reversible and irreversible changes in matter helps us understand the different ways matter can change.

CONCEPT 3: Suitability

Focus Question: Why is understanding the properties of matter useful?

Comparing the properties of different writing tools helps us understand how different materials are suited for different purposes.

APPLICATION OF CONCEPTS: Building a Shelter

Using the engineering design process and our knowledge of materials and their properties, we will build a shelter that protects from the rain.

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SUPPORTING YOUR YOUNG SCIENTIST AT HOME

ONGOING CONVERSATIONS

Support science learning at home by having conversations about matter and its properties. Here are some suggestions to get you started:

- Play a guessing game where one person describes an object's properties (e.g., shape, size, color) and the other person guesses the object.
- Talk about different solids and liquids in the home. For example, many foods are solids and liquids with different properties.
- Discuss how different objects around the home are suited for different jobs. For example, many tools have different properties that correspond to their functions.

ACTIVITIES

These activities support and extend classroom learning:

- Invite your student to cook or bake with you and talk about the properties of the different ingredients and how the food changes as it is mixed or cooked.
- Visit a park or zoo to observe different nests or animal homes. Talk about the materials used and how they are suited to that particular animal home.
- Safely explore melting and freezing with different liquids, such as water or juice.

BOOKS

Local libraries are a great resource for fiction and nonfiction books related to matter. Browse the library catalog or start with these suggestions:

- *Animal Architects: Amazing Animals Who Build Their Homes* by Daniel Nassar and Julio Antonio Blasco
- *Spit & Sticks: A Chimney Full of Swifts* by Marilyn Grohoske Evans
- *Birds Build Nests* by Elizabeth Raum

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Level 2 Module 2: Earth Changes

CONTENT OVERVIEW

ANCHOR PHENOMENON: Transformation of Surtsey

Essential Question: How can the island of Surtsey change shape over time?

By studying changes to Surtsey's land, we can understand that natural events change Earth's land over time.

CONCEPT 1: The Composition and Shape of Land

Focus Question: How can we describe land?

Investigating rock, soil, and sand samples helps us understand what land is made of. Observing landforms helps us understand that land can take many different shapes.

CONCEPT 2: The Changing Shape of Land

Focus Question: How can land change?

Investigating the movement of sand, soil, and gravel by water and wind helps us understand how water and wind cause land to change shape.

APPLICATION OF CONCEPTS: Slowing or Preventing Changes to Land

Using the engineering design process and our knowledge of how water can change land, we design a shoreline protection system for preserving a model shoreline and preventing a lighthouse from falling into the ocean.

CONCEPT 3: Timescales of Changes to Land

Focus Question: How long do changes to land take?

Comparing Earth events that change land and the time spans over which these events occur helps us understand that some events change land very quickly and others happen very slowly over time spans significantly longer than a human lifetime.

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SUPPORTING YOUR YOUNG SCIENTIST AT HOME

ONGOING CONVERSATIONS

Support science learning at home by having conversations about changes to Earth's land. Here are some suggestions to get you started:

- Point out the different natural features of land you see as you walk or drive through your local area.
- Talk about the natural features of land in places you have visited or would like to visit.
- Discuss how wind and water are changing the land in your local area.
- Discuss how people are changing the land in your local area. Compare the ways that people change land to the ways that wind and water change land.

ACTIVITIES

These activities support and extend classroom learning:

- Search for rocks and start a rock collection. Consider checking out a field guide from the library to help identify different rocks.
- Visit a landform in your local area. Have your student sketch or photograph the landform and label the landform's observable properties.
- Research the natural features of land in national parks. Most national park websites provide detailed pictures and descriptions of their landforms.

BOOKS

Local libraries are a great resource for fiction and nonfiction books related to changes to Earth's land. Browse the library catalog or start with these suggestions:

- *Volcano Rising* by Elizabeth Rusch
- *Island: A Story of the Galápagos* by Jason Chin
- *Earth Verse: Haiku from the Ground Up* by Sally M. Walker

WEBSITES

Keep the learning about changes to Earth's land going by exploring these internet resources:

- Visit the Natural Bridges National Monument website (https://www.nps.gov/nabr/learn/nature/geologicformations.htm) to learn more about natural bridges.
- Visit the Hawai'i Volcanoes National Park website (https://www.nps.gov/havo/learn/nature/volcanoes.htm) to learn more about volcanoes.

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Level 2 Module 3: Plants

CONTENT OVERVIEW

ANCHOR PHENOMENON: Plant Recovery Around Mount St. Helens

Essential Question: How did local plants recover after the eruption of Mount St. Helens?

By studying how plants recovered in the area around Mount St. Helens after the volcano's 1980 eruption, we learn that different kinds of plants have different needs for growth and depend on certain interactions for pollination and seed travel.

CONCEPT 1: Plant Growth

Focus Question: Do different amounts of natural resources change how well a certain kind of plant grows?

Observing photographs of Mount St. Helens before and after the volcano's eruption and investigating how water or light affect plant growth helps us understand that different kinds of plants grow differently when they receive different amounts of water or light.

CONCEPT 2: Pollination

Focus Question: How can pollination involve animals?

Examining the interactions of plants and animals helps us recognize that animals can pollinate plants and plants must be pollinated to produce seeds.

APPLICATION OF CONCEPTS: Humans Pollinating a Plant

Using the engineering design process and our knowledge of pollination, we design, build, and test a tool that would allow humans to pollinate plants.

CONCEPT 3: Seed Travel

Focus Question: How can seeds travel to new places?

Exploring the different ways that animals move seeds and observing the properties of seed coverings helps us understand that seeds can travel to new places in many ways.

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SUPPORTING YOUR YOUNG SCIENTIST AT HOME

ONGOING CONVERSATIONS

Support science learning at home by having conversations about plants. Here are some suggestions to get you started:

- Talk about plants around your home and in your local area, such as in a park or near a body of water.
- Point out a construction site and discuss what plant growth might occur if people do not add any plants to the finished site.
- Discuss different examples of animal and plant interaction in your community, such as pollination and seed travel.

ACTIVITIES

These activities support and extend the learning going on in the classroom:

- Plant a seed or a young plant in a planter or in the ground and observe its growth. Encourage your student to use drawings, words, or photographs to record changes to the plant in a journal.
- Visit a park or a botanical garden to observe different plants. Sketch or take photos of the plants and research how the plants are pollinated.
- Start a seed collection and describe the properties of the seed coverings.

BOOKS

Local libraries are a great resource for fiction and nonfiction books related to plants. Browse the library catalog or start with these suggestions:

- *From Seed to Plant* by Gail Gibbons
- *The Night Flower* by Lara Hawthorne
- *Plant Secrets* by Emily Goodman

WEBSITES

Keep the learning about plants going by exploring this internet resource:

- Visit the Mount St. Helens Science and Learning Center website (https://www.mshslc.org/) to learn more about Mount St. Helens and its eruptions.

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Level 2 Module 4: Biomes

CONTENT OVERVIEW

ANCHOR PHENOMENON: Environments on and Below Mount Everest

Essential Question: Why do so many kinds of plants and animals live below Mount Everest but so few live on it?

By studying and comparing the kinds of plants and animals that live in different environments on and below Mount Everest, we learn that Earth's land and water environments support many different species.

CONCEPT 1: Environments

Focus Question: How can we describe an environment?

Identifying the plants, animals, and yearly weather patterns of different environments helps us describe and compare environments by their living and nonliving components.

CONCEPT 2: Biomes

Focus Question: How do biomes compare with one another?

Examining biome maps and analyzing weather, plant, and animal information for different biomes helps us describe and compare the many kinds of biomes that exist on Earth.

APPLICATION OF CONCEPTS: Plants and Animals in Our Schoolyard

Investigating the number of different kinds of plants and animals that live in our schoolyard allows us to describe the biodiversity of our schoolyard.

CONCEPT 3: Biodiversity

Focus Question: How does biodiversity compare between environments?

Describing and comparing the number of species supported by Earth's environments helps us understand that some environments support more species than others.

SUPPORTING YOUR YOUNG SCIENTIST AT HOME

ONGOING CONVERSATIONS

Support science learning at home by having conversations about biomes. Here are some suggestions to get you started:

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- Point out the features of different maps you have in your home or that are posted in your community, such as a bus or trail map.
- Talk about the different kinds of plants and animals that live in your local area.
- Discuss the different environments and biomes that your student is learning about in school.
- Compare the kinds of plants and animals that live in your local area to the kinds of plants and animals that live in an area far away.

ACTIVITIES

These activities support and extend classroom learning:

- Draw a map of a familiar place, such as your home, your yard, or a local park.
- Encourage your student to use drawings, words, or photographs to record the different kinds of plants and animals you find near your home or in a park.
- Create a game with your student in which animals and plants are matched to the biome in which they live.
- Visit national parks websites to research different biomes in the United States.

BOOKS

Local libraries are a great resource for fiction and nonfiction books related to biomes. Browse the library catalog or start with these suggestions:

- *Sacred Mountain: Everest* by Christine Taylor-Butler
- *Down, Down, Down: A Journey to the Bottom of the Sea* by Steve Jenkins
- *A Strange Place to Call Home: The World's Most Dangerous Habitats & the Animals That Call Them Home* by Marilyn Singer

WEBSITES

Keep the learning about biomes going by exploring these internet resources:

- Visit the National Park Service Mountains website (https://www.nps.gov/subjects/mountains/plants.htm) to learn more about plant life in different mountain environments.
- Visit the National Park Service Glacier Bay National Park and Preserve website (https://www.nps.gov/glba/learn/nature/naturalfeaturesandecosystems.htm) to learn about the various environments of Glacier Bay in Alaska.

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