Grade 4 Planning Guide

Kindergarten Planning Guide | Grade 1 Planning Guide | Grade 2 Planning Guide
Grade 3 Planning Guide | Grade 4 Planning Guide | Grade 5 Planning Guide
Combined K-5 Planning Guide

What is Included in this Document?

Grade Level Pacing Guides
The Pacing Guide is a resource to support your year-long planning. The units can be taught in any order. In most units, the lessons build on one another. Therefore, we strongly recommend the lessons within each unit are taught in the sequence they are presented. Extensions are available for each lesson and offer an opportunity for students to continue their science content learning. They include assessments and a curated collection of additional activity suggestions, online resources, project ideas, and readings.

Mystery Science - NGSS Alignment
Mystery Science is aligned to the Next Generation Science Standards (NGSS). Each lesson is aligned to a topic, performance expectation, science and engineering practice, disciplinary core idea, and crosscutting concept. This document explains how each lesson is aligned to the Next Generation Science Standards. If you are interested in anchoring phenomena, we suggest using our Anchor Layer feature and exploring our NGSS Storylines.

Generate Activity Supply Lists
To make planning easier, you can generate supply lists by grade, classroom, unit, or lesson using our Supply Calculator.

Table of Contents

Grade 4

Mystery Science recommends teaching the lessons within each unit in the order they are presented. The units themselves can be taught in any order. The lesson (exploration & activity) is designed to take an hour per week. Extensions can expand upon each lesson.

	Human Machine (4-8 weeks)	Birth of Rocks (5-10 weeks)	Waves of Sound (3-6 weeks)	Energizing Everything (8-16 weeks)
Week 1	Lesson 1: Why do your biceps bulge? ***(4-LS1-1)***	Lesson 1: Could a volcano pop up where you live? (***4-ESS1-1, 4-ESS2-2)***	Lesson 1: How far can a whisper travel? (***4-PS4-1, 4-PS4-3)***	Lesson 1: How is your body similar to a car? (***4-PS3-1, 4-PS3-4)***
Week 2	Lesson 2: What do people who are blind see? ***(4-LS1-1, 4-LS1-2, 4-PS4-2)***	Lesson 2: Why do some volcanoes explode? (***4-ESS1-1)***	Lesson 2: What would happen if you screamed in outer space? (***4-PS4-1)***	Lesson 2: What makes roller coasters go so fast? (***4-PS3-1, 4-PS3-3)***
Week 3	Lesson 3: How can some animals see in the dark? ***(4-LS1-1, 4-LS1-2, 4-PS4-2)***	Lesson 3: Will a mountain last forever? (***4-ESS1-1, 4-ESS2-1)***	Lesson 3: Why are some sounds high and some sounds low? (***4-PS4-1)***	Lesson 3: Why is the first hill of a roller coaster always the highest?***(4-PS3-3)***
Week 4	Lesson 4: How does your brain control your body? (***4-LS1-1, 4-LS1-2)***	✨**New!**✨ Lesson 4: What did your town look like 100 million years ago? ***(4-ESS1-1)***		Lesson 4: Could you knock down a building using only dominoes? (***4-PS3-4, 3-5-ETS1-1)***
Week 5		Lesson 5: How could you survive a landslide? ***(4-ESS2-1, 4-ESS3-2)***		Lesson 5: Can you build a chain reaction machine? (***4-PS3-4, 3-5-ETS1-1, 3-5-ETS1-2, 3-5-ETS1-3)***
Week 6				Lesson 6: What if there were no electricity? (***4-PS3-2, 4-PS3-4)***
Week 7				Lesson 7: How long did it take to travel across the country before cars and planes? (***4-PS3-2, 4-PS3-4)***
Week 8				Lesson 8: Where does energy come from? (***4-ESS3-1)***

Lesson Extensions. Extensions are available for each lesson and offer an opportunity for students to continue their science content learning. They include assessments and a curated collection of additional activity suggestions, online resources, project ideas, and readings.

More Science each week	Longer Science units	Cross Curricular Integration
Use items from the Extensions if you have more time.	Add a week after each lesson to teach items from the Extensions.	If you want to extend the lesson during literacy time, use reading and writing Extensions.

Human Machine (4-8 weeks)

Body, Senses, & the Brain

Grade 4 Mystery Science & NGSS Alignment - Life Science (LS)

In this unit, students investigate structures and functions of the human body. Students explore how our bones and muscles are interconnected, how our eyes interact with light and impact our vision, and how our brain responds to stimuli in our environment.

Grade 4 Life Science	Performance Expectations	Focus	Disciplinary Core Ideas (DCIs) (Lesson Conceptual Flow)	Scientific & Engineering Practices (SEPs)	Crosscutting Concepts (CCC)
Lesson 1 Why do your biceps bulge?	4-LS1-1	Muscles & Skeleton	Like a machine or robot, the body has parts, or structures, for moving around (e.g. the limbs). In order to move (one of the body's functions), the body needs at least two things: muscles and bones. The contraction of your muscles pulls on tendons, which in turn pull on the bones, causing you to move. Your external parts (such as appendages) are controlled by your brain like a marionette puppet (a topic we explore in Lesson 4). **DCIs: LS1.A**	Students **build a model** of a finger that they then use to **construct an explanation** for how fingers move.	Students consider how human motion is made possible by a **system** of muscles, tendons and bones. Students consider the **cause and effect** relationship between tendons and the muscles and bones that they move.
Lesson 2 What do people who are blind see?	4-LS1-1 4-LS1-2 4-PS4-2	Light, Eyes, & Vision	Continuing the analogy of the body as a machine or robot, we now consider its "sensors"--the sensory organs, in this lesson focusing specifically on the eyes. Students discover the basics of how their eyes work, and figure out some of the causes of vision problems. **DCIs: LS1.A; *Foundational for* LS1.D, PS4.B**	Students **build a model** of a eyeball that they then use to **construct an explanation** of why some people have blurry vision.	Students think about how the eye works as a **system** of different parts that interact to facilitate vision. Students consider how light interacts with the system to determine what images we see (**cause and effect**.)
Lesson 3 How can some animals see in the dark?	4-LS1-1 4-LS1-2 4-PS4-2	Structure & Function of Eyes	Students delve further into the workings of the eye, exploring the function of their iris and pupil. **DCIs: LS1.A; *Extends* LS1.D, PS4.B**	Students **conduct an investigation** to see how pupils change in response to light. Students **build a model** of an eye (extending the model they built in Lesson 2) to **explain** how changes in pupil size changes the image that appears on the retina.	Students continue to think about how the eye works as a **system** and how changes to each part impact the system as a whole. Students also reason about the effect of changes in pupil size (**cause and effect).**
Lesson 4 How does your brain control your body?	4-LS1-1 4-LS1-2	Brain, Nerves, & Information Processing	Continuing the analogy of the body as a machine or robot, we finally consider the body's 'build-in computer' or central processor: the brain, and its accompanying nerves. Students explore the brain's role in receiving information from the senses, processing that information, and controlling the muscles to enable movement. **DCIs: LS1.A, LS1.D**	Students **conduct investigations** to explore how the brain processes information and responds to that information. Students **analyze and interpret data** from the investigations to determine how fast their reflexes are.	Students identify **patterns** based on how their brains process information.

Birth of Rocks (5-10 weeks)

Rock Cycle, Erosion, & Natural Hazards

Grade 4 Mystery Science & NGSS Alignment - Earth & Space Science (ESS)

In this unit, students investigate features and processes of the Earth's surface. Students explore the rapid process of volcanic eruptions! In contrast, students also explore the gradual Earth processes of weathering and erosion. Students apply their knowledge and design solutions to mitigate the impacts of these processes on humans.

Grade 4 Earth Science	Performance Expectations	Focus	Disciplinary Core Ideas (DCIs) (Lesson Conceptual Flow)	Scientific & Engineering Practices (SEPs)	Crosscutting Concepts (CCC)
Lesson 1 Could a volcano pop up where you live?	4-ESS1-1 4-ESS2-2	Volcanoes & Patterns of Earth's Surface	Rocks begin as lava--volcanic rocks are lava that has been frozen in time. Volcanoes don't just exist--they *form*, or 'pop up'. There is a pattern to where most volcanoes exist today on the earth. And yet dead volcanoes--and volcanic rock they erupted--can be found in *lots* of places. (So the pattern today isn't necessarily what it used to be.) You can look for volcanic rocks near you. **DCIs: ESS1.C, ESS2.B**	Students **analyze and interpret data** from recent volcanic eruptions. They use their findings as **evidence for an argument** that volcanoes are (or are not) likely to erupt in their backyard.	Students identify **patterns** about the location of the world's volcanoes and use these patterns as evidence to support an argument about why a volcano may or may not erupt in their backyard.
Lesson 2 Why do volcanoes explode?	4-ESS1-1	Volcanoes & Rock Cycle	Volcanic rocks are lava frozen in time. There are two primary types of lava, each of whose thickness explains two major differences in a volcano's shape & style of eruption. These two lavas also account for two commonly observed volcanic rocks that you might find. **DCIs: *Foundational for* ESS2.B; *Extends* ESS2.B**	Student **conduct an investigation** to **construct an explanation** for why some volcanoes explode and why some do not. Students **model** thick and thin lava to conduct their investigations.	Students reason about the **cause and effect** of the type of lava (cause) and the nature of the eruption (effect) as well as the shape of the volcano (effect).
Lesson 3 Will a mountain last forever?	4-ESS2-1	Weathering & Erosion	Rock does not stay as massive monoliths of volcanoes--it tends to get broken into smaller pieces (sediments) over time due to natural forces (weathering), and tumble downhill (erosion). You can look for evidence of this where you live. **DCIs: ESS2.A**	Students **conduct an investigation** by **modeling** how rocks weather away over time. Students **construct an explanation** for why rocks look smoother at the bottom of a mountain compared to the top of a mountain.	Students consider the **cause and effect** of ice and root wedging on rock as it is broken down into small pieces.
✨**New!**✨ Lesson 3 What did your town look like 100 million years ago?	4-ESS1-1	Sedimentary Rock & Fossils	Change is constant. Sediments are continually moving (erosion) and settling in locations (deposition). These sediments can bury the remains of animals and plants that transform into fossils over time. We can use the location patterns of fossils within rock layers to understand the history of the organisms that lived there, but also of the land formation within an area. **DCIs: ESS1.C**	Students create a model canyon and explore the fossils found within each rock layer. They use this model to **construct an explanation** that the landscape has changed multiple times and that older rock layers, and therefore older fossils, are found at the bottom of the canyon.	Students use their canyon model to examine **patterns** of fossils in each layer to support the explanation that the environment has changed multiple times.
Lesson 4 How could you survive a landslide?	4-ESS2-1 4-ESS3-2	Erosion, Natural Hazards, & Engineering	The erosion process is not benign; it creates some of the worst natural hazards, including rock falls, landslides, and debris flows. If we are to be safe from these hazards, we have to design solutions to protect us. **DCIs: ESS3.B**	Students **design solutions** to protect their "homes" from rock slides. Students **argue** for the merits of their design.	**Engineering** a solution to landslide hazards **depends on scientific knowledge** about the causes of landslides.

Waves of Sound (3-6 weeks)

Sound, Waves, & Communication

Grade 4 Mystery Science & NGSS Alignment - Physical Science (PS)

In this unit, students investigate the science of sound. Students construct physical devices to feel the vibrations that allow us to communicate across distances. Students also use digital devices to visualize the characteristics of different sound waves that cause us to hear different things.

Grade 4 Physical Science	Performance Expectations	Focus	Disciplinary Core Ideas (DCIs) (Lesson Conceptual Flow)	Scientific & Engineering Practices (SEPs)	Crosscutting Concepts (CCC)
Lesson 1 How far can a whisper travel?	4-PS4-1 4-PS4-3	Sound, Vibrations, & Engineering	Sounds aren't something we can see or touch, and so it's easy to dismiss them as not fully real. But if you've experienced an echo before, then clearly there is something interesting and very real about sound--we can even feel and see that sound has something to do with vibrations. Students observe a relationship between sound and vibration, and through the activity, discover evidence that sound isn't merely related to vibrations, but perhaps, *is* a vibration. **DCIs: *Foundational for* PS4.A**	Students document their understanding of how vibrations travel using a **model** of their paper cup telephones. Students then **design their own series of investigations** to figure out how to make their telephone work better in different circumstances. Students **construct an explanation** of how the telephone works. Students extend the lesson by developing a way to send a message using a pattern of sounds.	Students identify **patterns** about the relationship between the tension of the string and the quality of the sound it produces. Students also investigate **patterns** in the how different materials affect the quality of the sound that is transmitted.
Lesson 2 What would happen if you screamed in outer space?	4-PS4-1	Sound & Vibrations	Sound can travel through lots of different materials: through water, through string… it's possible to even *feel* the vibrations in the string, pinch the string, and stop the vibrations from reaching the other side. It would seem that sound is a vibration that must travel from one place to another. So does that mean sound is vibrating the air? (It is.) And what happens if there is no air? (There is no sound!) **DCIs: PS4.A**	Students **conduct investigations** with balloons to experience the vibrations caused by sound of their voices. Students **construct an explanation** that sound is a vibration. Students then **develop a model** to explain how sound travels through a medium and how it can cause distant objects to move.	Students consider the **effect** of vibrations on the movement of distant objects.
Lesson 3 Why are some sounds high and some sounds low?	4-PS4-1	Sound Waves & Wavelength	Some sounds are very high-pitched, while others are low-pitched. For example, young people can even hear certain high-pitched sounds that adults can no longer hear. What makes one sound high and another low? By examining some musical instruments played in slow motion, we can begin to detect some differences in the vibrations. Special instruments enable us to visualize the resulting air vibrations, and reveal that sound vibrations travel as waves in the air. Students discover that the difference between high and low-pitched sounds has to do with the length of these waves ("wavelength"). **DCIs: PS4.A**	Students **analyze and interpret data** from oscilloscopes to determine how wavelengths differ between high and low pitch sounds. Students make claims and **argue from evidence** about which wavelength patterns were generated from different pitches. Students then use a rope to **model** waves created by different pitches and begin to explore the relationship between wavelength and frequency.	Students identify and analyze the oscilloscope **patterns** made by sounds with low and high pitches.

Energizing Everything (8-16 weeks)

Energy & Motion

Grade 4 Mystery Science & NGSS Alignment - Physical Science (PS)

In this unit, students explore energy! Students investigate how energy is stored, how it can make objects move, and how collisions transfer energy between objects. Students also construct devices that convert energy from one form into another, such as heat into motion and electricity into light.

Grade 4 Physical Science	Performance Expectations	Focus	Disciplinary Core Ideas (DCIs) (Lesson Conceptual Flow)	Scientific & Engineering Practices (SEPs)	Crosscutting Concepts (CCC)
Lesson 1 How is your body similar to a car?	4-PS3-1 4-PS3-4	Speed & Energy	When something is moving, it has energy. Moving things get their energy from stored energy, and energy can be *stored* in different ways (gasoline, batteries, food, springs, and rubber bands). Students discover that the faster an object is moving, the more energy it has. They compare models that use thin rubber bands and thick rubber bands to determine how differences in stored energy directly relate to the speed of the object. **DCIs: PS3.B, Foundational for PS3.A**	Students **build a model** of an amusement park ride called the Twist-o-Matic. They use the model to **carry out an investigation** to examine the relationship between energy and speed. Students **analyze and interpret data** from their models, comparing the speed of the ride using a thin versus thick rubber band.	Students explore how **energy** can be stored and released using a rubber band. The amount of **energy** that is put into the **system** is related to the speed of the model spinning around.
Lesson 2 What makes roller coasters go so fast?	4-PS3-1 4-PS3-3	Collisions & Energy Transfer	Giving something "height" (putting it up high) is another way to store energy. When the object falls or drops, that stored energy is released: this explains why roller coasters work, but also bicycling downhill or skiing. The higher up you place an object, the more energy you store in it, and the faster it goes when released or dropped. When an object collides with another object, some of its energy is transferred to the object and some is transferred to the air. **DCIs: PS3.A**	Students **build a model** of a roller coaster and carry out an investigation using marbles. Students **analyze and interpret data** from the model to explain the connection between height, energy, and speed. Students also start to build an understanding of energy transfer as they observe what happens when additional marbles (additional collisions) are added to the model.	Students consider how **energy** is stored, released, and transferred in a **system** as they experiment with their marble roller coasters.
Lesson 3 Why is the first hill of a roller coaster always the highest?	4-PS3-3	Energy Transfer & Engineering	Something that's falling only has as much energy as was stored in it in the first place. This is why you can notice a pattern with roller coasters - the first hill is always the highest. When an object collides with another object, some of its energy is transferred to the object and some is transferred to the air. **DCIs: PS3.B**	Students **conduct an investigation** using a model roller coaster to determine how energy can be stored in the hills of the coaster. Students **analyze and interpret data** from the model to understand that marbles must start at the tops of hills so that they will have enough energy to reach the goal at the end of the track.	Students consider how **energy** is stored and released in a system as they experiment with their marble roller coasters.
Lesson 4 Could you knock down a building using only dominoes?	4-PS3-4 3-5-ETS1-1	Energy Transfer & Engineering	We can invent devices that convert stored energy into movement, and transfer that energy to various other objects along a pathway. **DCIs: PS3.A, PS3.C, ETS1.A**	Students begin to **design** a chain reaction machine. They start by figuring out how to connect two components of the chain reaction: the lever and the slide. This is the basis of the machine they will further develop in Lesson 5.	Students consider the ways in which **energy** can be stored, released, and transferred as they trace the path of energy through a chain reaction.

(continued)

Energizing Everything (8-16 weeks)

Energy & Motion

Grade 4 Mystery Science & NGSS Alignment - Physical Science (PS)

Grade 4 Physical Science	Performance Expectations	Focus	Disciplinary Core Ideas (DCIs) (Lesson Conceptual Flow)	Scientific & Engineering Practices (SEPs)	Crosscutting Concepts (CCC)
Lesson 5 Can you build a chain reaction machine? (continuation of Lesson 4)	4-PS3-4 3-5-ETS1-1 3-5-ETS1-2 3-5-ETS1-3	Energy Transfer & Engineering	Engineers are people who design or invent solutions to problems by using knowledge of science. All engineers think about what their goal is, come up with multiple ideas, test those ideas out, and repeatedly fail until they figure out what works. **DCIs: PS3.A, PS3.C, ETS1.A**	Students **design** a chain reaction machine that displays a message at the end. The chain reaction machines use multiple components that transfer energy from one part to the next.	Students consider the ways in which energy can be stored and released as they trace the path of energy through a chain reaction.
Lesson 6 What if there were no electricity?	4-PS3-2 4-PS3-4	Electrical Energy	Electricity--the stuff from our outlets and batteries--is a form of energy that we use to produce *movement*, but also light, heat, and more. Just like the energy in a chain reaction machine, electricity moves along a path and so can be transferred from one place to another. We can use such knowledge about electrical energy to design solutions to problems (such as flashlights for seeing in the dark). **DCIs: PS3.B, ETS1.A**	Students **design** a flashlights using batteries, lights and tin foil. Students experiment with different ways of constructing their flashlights so that they turn on and off.	Electricity is a form of **energy** that can be stored (such as in batteries) and transferred via wires, where it is used to produce not only movement, but also light, heat, and more.
Lesson 7 How long did it take to travel across the country before cars and planes?	4-PS3-2 4-PS3-4	Heat Energy & Energy Transfer	The invention of the engine was a monumental step forward for human transportation; it used heat energy released from burning fuel to move people and goods over long distances much more safely, cheaply, and quickly. Engines are chain reaction machines--heat is transferred through a device to create movement! **DCIs: PS3.B, PS3.D**	Students build a paper spinner and **conduct an investigation** to explain how heat makes things move.	Heat is a form of **energy** that can be transferred to create movement.
Lesson 8 Where does energy come from?	4-ESS3-1	Renewable Energy & Natural Resources	Some natural resources such as wood, coal, and natural gases can be burned to release energy. Unfortunately, burnable sources of energy release smoke and cause air pollution. Many scientists are exploring alternative natural sources of energy such as solar, wind, and water. These natural sources don't require burning to release energy. **DCIs: PS3.D, ESS3.A**	Students evaluate the advantages and disadvantages of alternative energy sources to power a town. They **obtain and evaluate information** about the needs of each source of energy and **analyze and interpret data** about the town's resources.	Natural resources such as coal, the sun, wind, and wood can be used for **energy**. Using these resources (**cause**) can damage the **environment (effect)**.