

# Elementary PHENOMENA

# CANNGSS



**STEM**<sup>CA NGSS 3D</sup>**scopes**<sup>™</sup>  
K-12 SCIENCE

[STEMscopescalifornia.com](http://STEMscopescalifornia.com)



**Coherence** means that student learning modules—units (segments), chapters (scopes), and lessons (hands-on exploration)—logically flow between one another and also build upon each other to form a sequence of student missions (performance expectations).

Our approach to coherence allows for **student choice** in learning progression and gives students a framework to link the application of the **three dimensions** to real-world phenomena using prior knowledge and new understandings and abilities.

STEMscopes' segments are coherent on two levels: lesson design via the **5E model** and **layered phenomena**—anchoring, investigative, and everyday. Each segment begins with an anchoring phenomena event, an anchoring phenomena driving question, and a mission action plan. Together, these drive the instructional focus of the scopes within a segment, while students explore a variety of phenomena and learn to apply their knowledge and abilities.

Each segment's scopes are tied to investigative and everyday phenomena, forming a bridge that builds students' knowledge progressively toward the segment's anchoring phenomena and mission action plan.

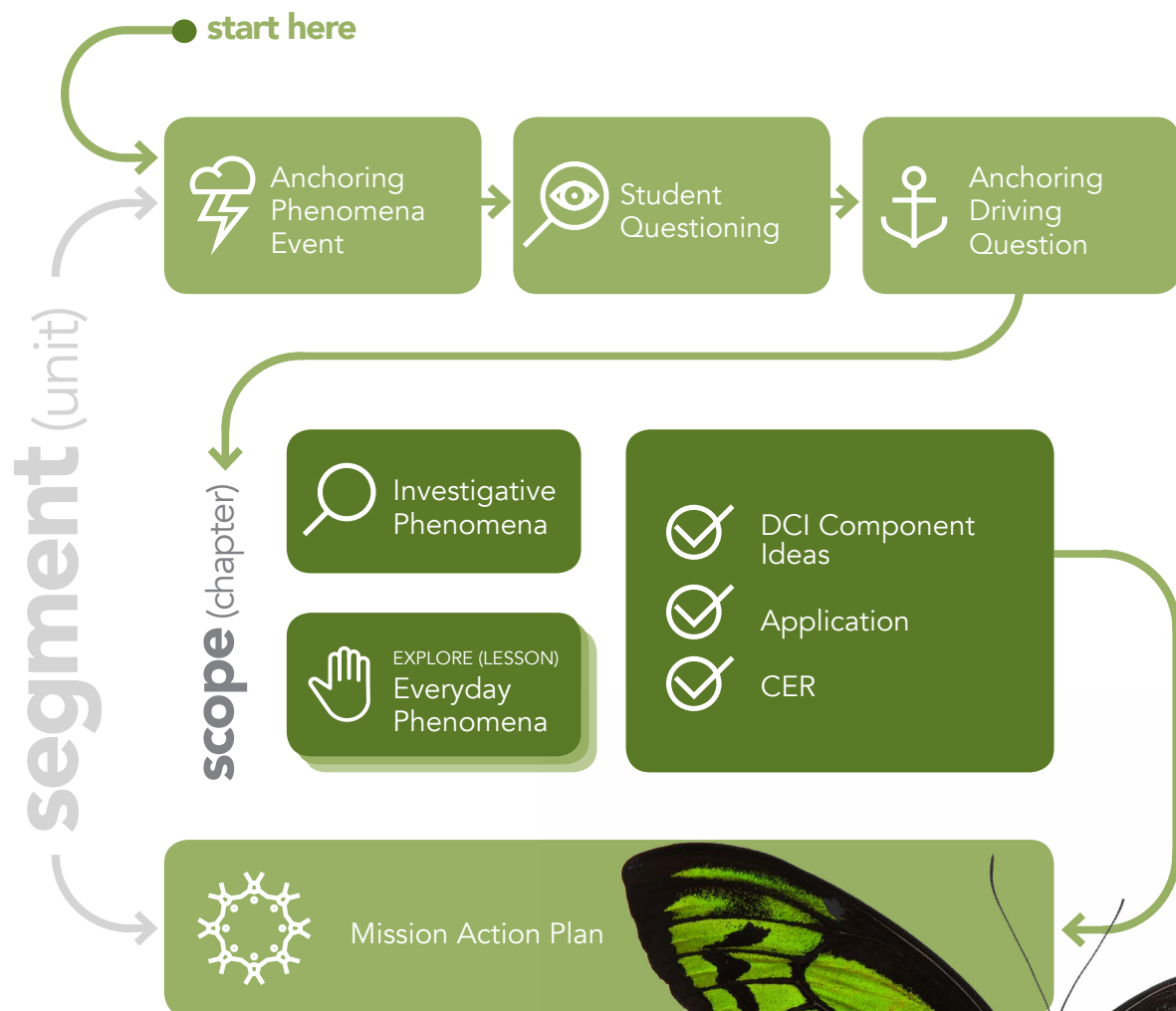


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## segment coherence overview

The STEMscopes segment coherence flowchart shown below illustrates how a segment (unit) and its scopes (chapters) are organized and work together. Each segment begins with an anchoring phenomena event, an anchoring phenomena driving question, and a mission action plan (performance expectation), which together drive the instructional focus of each scope. Scopes (chapters) are tied to investigative and everyday phenomena, forming a bridge that builds students' knowledge progressively toward the segment's anchoring event and driving question, and culminate in the mission action plan.



**mission log connects to additional scopes in segment**

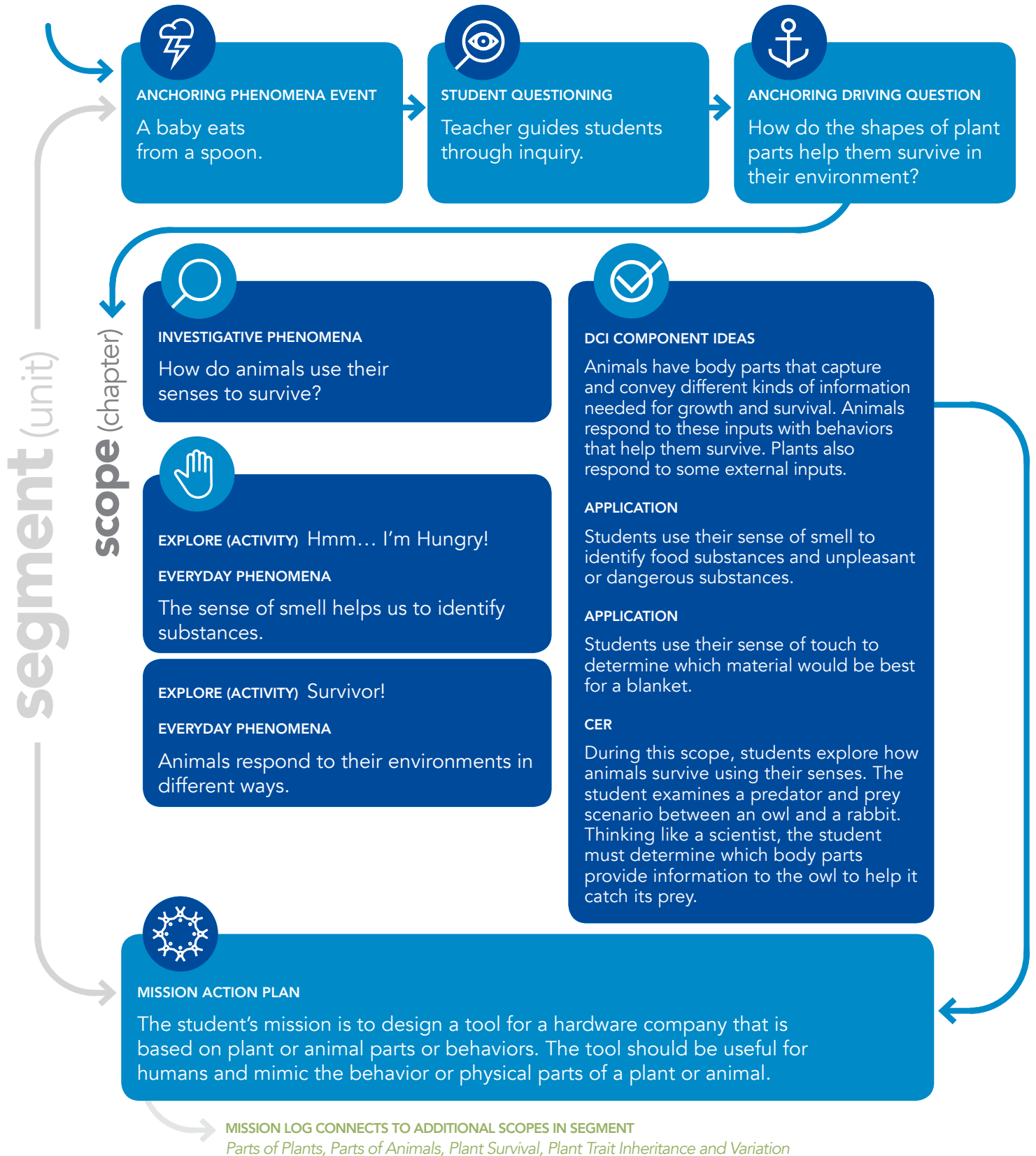
The number of scopes and investigative phenomena vary within each segment.



# 1st grade segment 4

PLANT SHAPES  
SCOPE: ANIMAL SURVIVAL

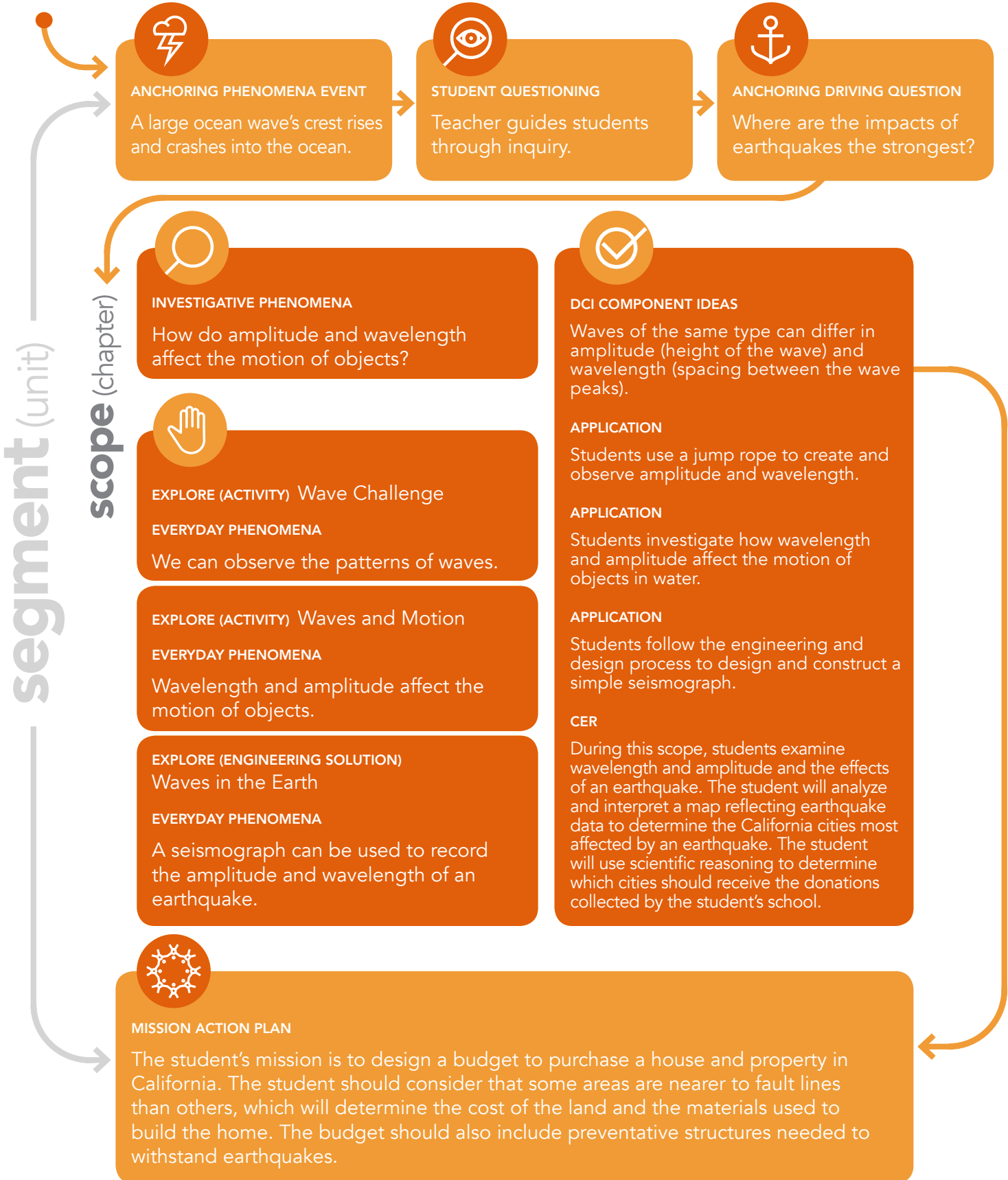
start here



# 4th grade segment 4

## EARTHQUAKE ENGINEERING SCOPE: WAVELENGTH & AMPLITUDE

start here



MISSION LOG CONNECTS TO ADDITIONAL SCOPES IN SEGMENT  
*Motion of Waves*



# FIGURING OUT

## introduction to STEMscopes PHENOMENA

Serving as the context for both scientists and engineers in their work, phenomena are predicted through scientific knowledge, which is then used to create solutions to real-world problems. STEMscopes centers STEM education around three layers of phenomena—anchoring, investigative, and everyday. Together, these form a coherent storyline supported by student-driven daily experiences and inquiry and evaluated by claim-evidence-reasoning assessments. Centering education around phenomena pushes students to move from learning about topics to figuring out why and how things happen, so they become scientists and engineers in the classroom.



# LEARNING





# kindergarten

## PHENOMENA SEGMENT 1

### Plant & Animal Needs

**Mission Story:** The student's neighbor has two new pet rabbits and needs help figuring out how to make a habitat for them. The student will help the neighbor build an outdoor habitat that meets the rabbits' needs for survival.

**Anchoring Event:** A family cooks together.

The students view a video of a family cooking, then participate in a teacher-led discussion about how cooking is meeting their needs. The teacher guides the discussion toward how an animal can meet its needs in a human-made habitat.

**Anchoring Phenomena Driving Question:** Can we meet all of the needs of an animal in a human-made habitat?

#### *Animal Needs*

*Investigative Phenomena:*

Do all animals have the same needs?

*Everyday Phenomena:*

Animals are classified by what they eat.

Animals eat different things.

#### *Plant Needs*

*Investigative Phenomena:*

Do all plants need the same things to survive?

*Everyday Phenomena:*

A lack of water affects a plant's growth.

Plants need light.

#### *Habitats*

*Investigative Phenomena:*

Why do animals live in different places?

*Everyday Phenomena:*

Habitats meet the needs of plants and animals.

Different types of habitats meet the needs of plants and animals.

#### *Uses of Natural Resources*

*Investigative Phenomena:*

Where do resources that I use every day come from?

*Everyday Phenomena:*

Humans use natural resources in everyday life.

Resources are made of different things.



## PHENOMENA SEGMENT 2

### Animals & Plants Can Change Their Environment

# kindergarten

**Mission Story:** The student's school has decided to make the playground bigger, and some trees will need to be cut down. Finches live in these trees, so they will need a new place to live. The student will create a new place for the finches to live using recycled materials.

**Anchoring Event:** A sea lion is trying to eat a piece of trash.

*The students begin by viewing a video of a sea lion eating trash in the ocean, then participate in a teacher-led discussion about the human impact on the environment. The teacher guides the discussion toward how humans can help plants and animals survive, and particularly how we could provide a new home for finches.*

**Anchoring Phenomena Driving Question:** How can we provide a new home for the finches?

### *Organisms' Impact on Environments*



*Investigative Phenomena:*

Why would a plant or animal change its environment?

*Everyday Phenomena:*

Animals' habitats look different before and after they are changed.

Beavers create ponds from rivers.

### *Reducing Human Impact*



*Investigative Phenomena:*

How do our choices impact the environment?

*Everyday Phenomena:*

Different types of pollution affect different parts of our environment.

Houses and roads can be designed to have smaller impacts on plants and animals.

Humans can reduce their impact on the environment.



# kindergarten

## PHENOMENA SEGMENT 3

### Weather Patterns

**Mission Story:** The student's best friend is coming to visit for a whole week. Their friend will travel from far away, where the weather is very different from the weather where the student lives. The student will help the friend decide what to pack for the trip.

**Anchoring Event:** Seasons change throughout the year and different weather patterns become observable.

The students first view a time-lapse video of the seasons, then participate in a teacher-led discussion about how the weather has patterns, like the seasons. The teacher guides the discussion toward how knowing patterns in the weather can help people prepare for a trip.

**Anchoring Phenomena Driving Question:** Can patterns in the weather help people prepare for a trip?

#### *Weather Conditions*

*Investigative Phenomena:*

What causes the weather to change each day?

*Everyday Phenomena:*

Weather is different around the world.

Different kinds of information is included in a weather report.



#### *Weather Patterns*

*Investigative Phenomena:*

How can we predict the weather?

*Everyday Phenomena:*

Temperature changes throughout the day.

Weather produces patterns over time.



#### *Weather Hazards*

*Investigative Phenomena:*

Why do people buy food, water, and other supplies for a bad storm?

*Everyday Phenomena:*

There are ways to prepare for extreme weather.

Structures can protect objects outside in a storm.



#### *Energy from the Sun*

*Investigative Phenomena:*

How does sunlight affect different types of surfaces on Earth?

*Everyday Phenomena:*

The ground's surface temperature in a sunny location is different from the surface temperature in a shady location.

Some surfaces heat up more than others.

Chocolate melts when it's outside under the sun.



## PHENOMENA SEGMENT 4

## Pushes &amp; Pulls

## kindergarten

**Mission Story:** The student and their friends want to play a game after school. It is raining, so the students will have to play a game inside. The student looks in the closet and can't find a game to play—they will need to make up a game of their own. In the student's house, there are two tennis balls, five water bottles, and a stack of books. The student will need to create a game using these objects.

**Anchoring Event:** A girl juggles a soccer ball.

*The students view a video of someone doing soccer tricks, then discuss how soccer moves require the forces of pushes and pulls in different directions. The teacher generalizes the discussion to ways in which we can change an object's motion through the use of force.*

**Anchoring Phenomena Driving Question:** How can we change an object's motion?

*Pushes and Pulls*

*Investigative Phenomena:*

How can we move something heavy?

*Everyday Phenomena:*

Different things happen to objects when we change the strength or direction of the force we are applying.

Some objects are harder to push and pull than others.

*Speed and Direction*

*Investigative Phenomena:*

What happens when objects collide?

*Everyday Phenomena:*

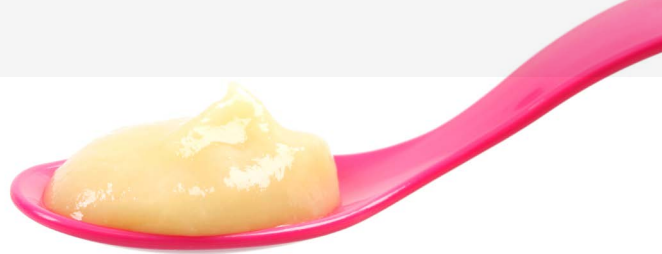
Something happens when a moving object collides with a stationary object.

We can use things like a ramp or another object to to speed things up and change direction.



# 1st Grade

## PHENOMENA SEGMENT 1 Plant Shapes



**Mission Story:** The student, who works for the Krazy Kidz channel, is going to create a new show. The show will be a cartoon about a plant family's life. The student's job is to design what each plant in the family looks like. The student will draw the plants using all different types of shapes and colors.

**Anchoring Event:** A baby eats from a spoon.

The students view a video of a baby eating from a spoon, then participate in a teacher-led discussion about how the shape of the spoon helps people eat and how plants and animals have parts that help them survive. The teacher guides the discussion about the shapes of plant parts that might help them survive in their environment.

**Anchoring Phenomena Driving Question:** How do the shapes of plant parts help them survive in their environment?

### *Parts of Plants*

*Investigative Phenomena:*

How can humans learn from plants?

*Everyday Phenomena:*

Different parts of plants help them grow.

People can mimic plants.

Scientists and engineers study plants to find helpful solutions for humans.



### *Parts of Animals*

*Investigative Phenomena:*

How can humans learn from animals?

*Everyday Phenomena:*

Animals' body parts help them move, eat, and survive in their habitat.

Different body parts help animals in different ways.

Scientists study animals to mimic how they use their body parts.

Humans copy animals' habits to create new inventions that help people in their everyday lives.



### *Plant Survival*

*Investigative Phenomena:*

What helps plants survive?

*Everyday Phenomena:*

Plants grow in specific directions.

Plants need certain things to start to grow.



### *Animal Survival*

*Investigative Phenomena:*

How do animals use their senses to survive?

*Everyday Phenomena:*

The sense of smell helps us identify substances.

Animals respond to their environment in different ways.



### *Plant Trait Inheritance and Variation*

*Investigative Phenomena:*

Why do plants not look exactly like their parent plants?

*Everyday Phenomena:*

Plants have different traits.

We can identify plant parents and offspring based on their traits.



PHENOMENA SEGMENT 2  
Animal Sounds

# 1st Grade

**Mission Story:** The student has a pet snake named Sammy. He rattles his tail to let others know he's there. One day, Sammy tried to warn people that they were getting too close. The people didn't hear him, so Sammy crawled into a bush with thorns and got a thorn stuck in his rattle. The student needs to make a new rattle for Sammy.

**Anchoring Event:** A mother bear interacts with her cub.

After viewing a video of a mother bear taking care of her cub, students participate in a teacher-led discussion about how the mother protects her young and uses sound to communicate with them. The teacher guides the discussion toward how other animals use sound to communicate.

**Anchoring Phenomena Driving Question:** How can animals use sound to communicate?

## Sound



*Investigative Phenomena:*

How do we make sounds?

*Everyday Phenomena:*

Sound affects other materials by vibrations.

Different materials make different types of sound.

## Communication



*Investigative Phenomena:*

How can we communicate over long distances?

*Everyday Phenomena:*

We can communicate without sound.

We can use both light and sound to communicate.

We can communicate over long distances using light and sound.

## Protecting the Young



*Investigative Phenomena:*

How do parents protect their babies?

*Everyday Phenomena:*

Parents help offspring meet their needs.

Animals protect their offspring.

## Animal Trait Inheritance and Variation



*Investigative Phenomena:*

Why does an animal not look exactly like its mother?

*Everyday Phenomena:*

Parents pass traits to their offspring.

We can identify parent and offspring.



# 1st Grade

## PHENOMENA SEGMENT 3 Shadows & Light

**Mission Story:** The student shares a room with their sibling. Their sibling is tired and wants to go to bed before the student. The student quietly walks into the dark room, and—thump!—the student hits a toe on the bed frame! It was too dark for the student to see where they were going. The student needs to make a night-light so they can see where they are going in the dark.

**Anchoring Event:** A girl is looking through yellow sunglasses.

*The students first view a video of someone looking through yellow sunglasses, then discuss how light changes as it passes through color. The teacher guides the discussion to other behaviors of light, and what causes shadows.*

**Anchoring Phenomena Driving Question:** What causes shadows?

### *Behavior of Light*

*Investigative Phenomena:*

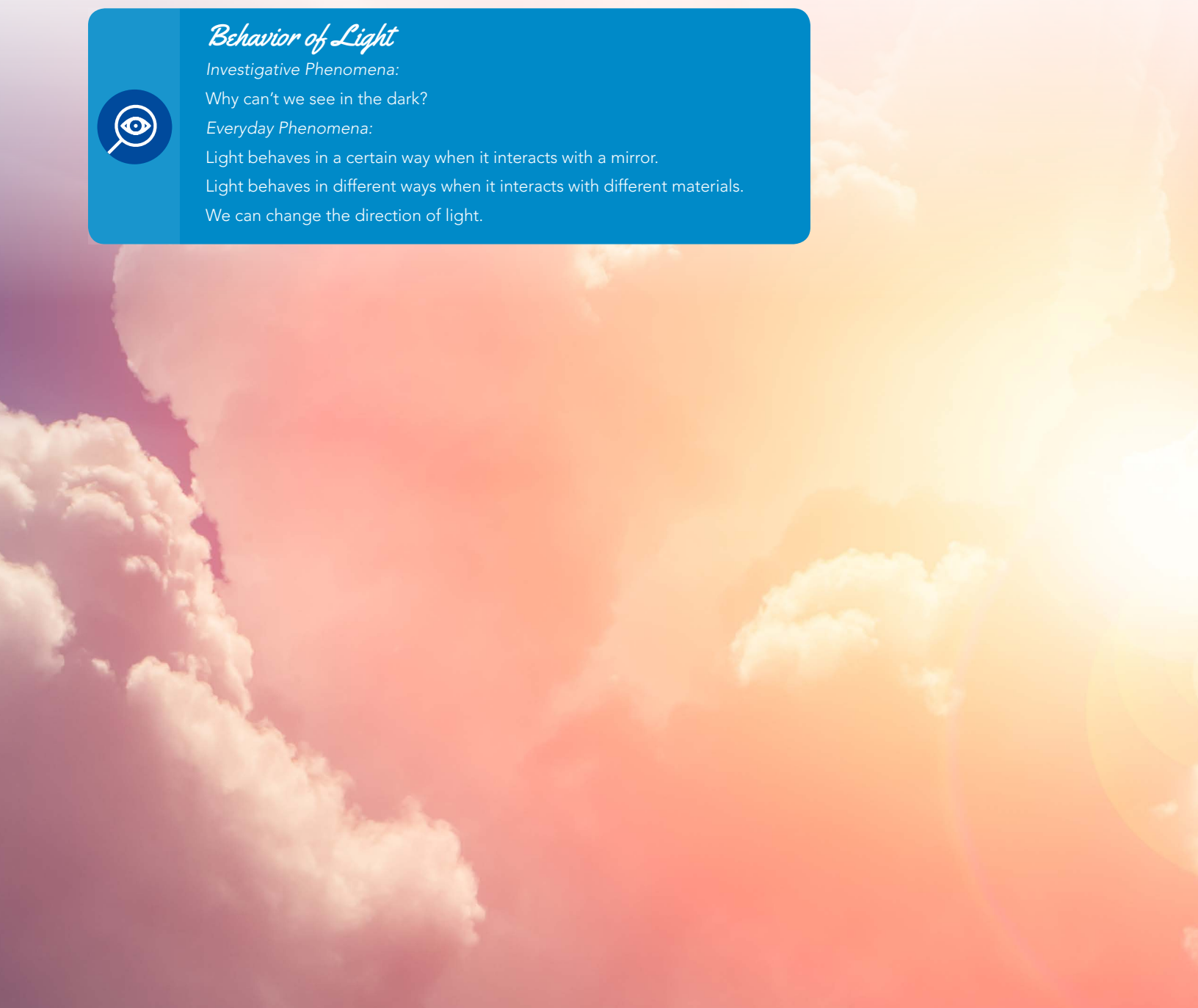
Why can't we see in the dark?

*Everyday Phenomena:*

Light behaves in a certain way when it interacts with a mirror.

Light behaves in different ways when it interacts with different materials.

We can change the direction of light.





PHENOMENA SEGMENT 4  
**Patterns of Motion of Objects in the Sky**

# 1st Grade

**Mission Story:** The student is planning their next birthday party, a fun way to celebrate a person's birthday. Would the student like to have a party? When is the student's birthday? What season is the student's birthday in? The student will use what they know about the seasons to plan their perfect birthday party.

**Anchoring Event:** Shadows move in a park over time.

*The students view a video of the Sun setting over a park, showing the changing shadows. The teacher leads them in a discussion about how shadows change throughout the day and have observable patterns as the seasons change throughout the year. The teacher guides the discussion to other patterns we notice about objects in the sky.*

**Anchoring Phenomena Driving Question:** What patterns do we notice about objects in the sky?

## *Patterns in Space*



*Investigative Phenomena:*

What are some patterns of the Sun, Earth, Moon system?

*Everyday Phenomena:*

Objects in the sky change throughout one day and night.

The positions of the Sun and Moon change.

## *Seasonal Patterns*



*Investigative Phenomena:*

How is day length related to the seasons?

*Everyday Phenomena:*

The number of daylight hours changes during the year.

The amount of sunlight affects our daily activities.

# 2nd grade

## PHENOMENA SEGMENT 1 Landscape Shapes

**Mission Story:** The students have been asked by a map company to make 3-D maps from flat maps. The students use the flat map to create a 3-D model out of clay.

**Anchoring Event:** Students follow the directions of a recipe.

The students view a video of students following the directions in a recipe, then participate in a teacher-led discussion about how recipes give directions on how to make something, in the same way that maps give us information that helps us find places. The teacher guides the discussion toward the information we need to describe the shapes of land and water on Earth.

**Anchoring Phenomena Driving Question:** How can we describe the shape of land and water on Earth?

### *Mapping Our World*

*Investigative Phenomena:*

How can flat maps show us where landforms are located?

*Everyday Phenomena:*

Landforms are represented on maps.

Maps help us navigate our surroundings.



### *Forms of Water on Earth*

*Investigative Phenomena:*

What are bodies of water like around the world?

*Everyday Phenomena:*

There are some factors that determine where bodies of water form.

It is important to know the location of bodies of water.



PHENOMENA SEGMENT 2  
Landscape Materials

# 2nd grade

**Mission Story:** Teams of students are competing in a castle-building contest, where each team has to use gravel, clay, or sand. Castles will be built outside on the playground and left out overnight before judging. The only thing that students can add to their material is water.

**Anchoring Event:** Workers are sorting recycling material.

After viewing a video of workers sorting recycling material, students participate in a teacher-led discussion about using physical properties to sort the recycling. The teacher guides the discussion toward the properties of materials and using what we know about them to determine which material is best for building a structure.

**Anchoring Phenomena Driving Question:** How can we use the properties of materials to determine which material is best for building a structure?

## *Properties and States of Matter*

*Investigative Phenomena:*

How many different ways can we classify objects?

*Everyday Phenomena:*

Heat affects the changes in states of matter.

We can identify an unknown substance by observing its physical properties.

There are different types of investigations we can conduct about the observable properties of matter or the states of matter.

## *Properties of Materials*

*Investigative Phenomena:*

How do we decide what material to make something out of?

*Everyday Phenomena:*

Some types of paper towels are stronger and more absorbent than others.

There are types of shoes that help us walk on smooth surfaces.

Observable properties of matter help us decide which type of material works best when building a model.

## *Building Blocks of Matter*

*Investigative Phenomena:*

How can we use pieces from one object to make new objects?

*Everyday Phenomena:*

Small pieces can be assembled in more than one way to build a bigger object.

We can build something to show that larger objects are made of smaller objects.

## *Changes from Heat*

*Investigative Phenomena:*

Why can some things changed by heating or cooling be reversed and some cannot?

*Everyday Phenomena:*

Heat has different effects on different types of materials.



# 2nd grade

## PHENOMENA SEGMENT 3 Landscape Changes

**Mission Story:** The students are given a weather forecast that predicts lots of rain and high winds, and a warning of possible mudslides. Students will develop a plan that includes a prediction of likely locations of a mudslide, how mudslides could change the landscape, and how to prevent mudslides in the future. Students will write a letter to the mayor of their town to share this information.

**Anchoring Event:** An ice cream bar is melting.

The students view a video of an ice cream bar melting, then discuss how the ice cream and the candy within it change over time, and what caused the changes. The teacher guides the discussion toward how slow and fast changes to Earth affect its landforms.

**Anchoring Phenomena Driving Question:** How do slow and fast changes affect landscapes?



### *Quick Changes to Land*

*Investigative Phenomena:*

Is it possible for land to look different in a matter of days?

*Everyday Phenomena:*

Volcanic eruptions change the land around them.

Environmental factors can shape the land.

Structures can be designed to withstand a natural disaster.



### *Slow Changes to Land*

*Investigative Phenomena:*

How can land change over millions of years?

*Everyday Phenomena:*

Wind and water change rocks and soil.

We can slow down changes in land.



### *Effects of Wind and Water*

*Investigative Phenomena:*

How can we prevent changes to land caused by wind or water?

*Everyday Phenomena:*

Some models of reducing erosion by wind and water work better than others.

We can decrease the amount of erosion to the land a beach house sits on.



PHENOMENA SEGMENT 4  
Biodiversity in Landscapes

# 2nd grade

**Mission Story:** The students write a story about the outdoor habitat at their school. All the plants and animals are getting along well and are happy until one day milk thistle shows up and starts changing their habitat. The students will write a story about this invasive plant, the milk thistle, appearing in their school habitat, and how this affects the habitat biodiversity.

**Anchoring Event:** A boy eats an apple from a tree.

The students view a video of a boy eating an apple, then participate in a teacher-led discussion about how the boy depends on the apple to meet his needs and what could happen if the boy were not able to get what he needs. The teacher generalizes the discussion to how plants and animals meet their needs and specifically how an invasive species could change the biodiversity of a habitat.

**Anchoring Phenomena Driving Question:** How could an invasive species change the biodiversity of a habitat?

## *What Plants Need*

*Investigative Phenomena:*

What do plants need to grow?

*Everyday Phenomena:*

Plants need the right amount of sunlight to survive.

Plants need the right amount of water to survive.

Water and sunlight have an effect on plants.



## *Animal and Plant Dependence*

*Investigative Phenomena:*

I know some animals depend on plants, but do plants depend on animals?

*Everyday Phenomena:*

Animal parts help spread pollen and seeds.

Specific features of animals help spread seeds.

We can combine features to create a super insect that could increase the speed at which pollen and seeds are spread.



## *Diversity of Living Things*

*Investigative Phenomena:*

How are plants and animals from different habitats different and similar?

*Everyday Phenomena:*

Animals in a rain forest can be compared to animals in a pond.

Habitats are suited for certain plants and animals.



# 3rd grade

## PHENOMENA SEGMENT 1 Playground Forces

**Mission Story:** The student is asked to design a new piece of equipment for the school's playground. The new piece of playground equipment should move by pushing or pulling on a part. The new equipment must use magnetic forces to hold a part in place or to keep parts from touching.

**Anchoring Event:** A person is playing billiards.

The students view a video of someone playing billiards, then participate in a teacher-led discussion about how hitting the ball in different places can change its direction. The teacher guides the discussion toward how forces change the motion of objects, using objects on a playground as an example.

**Anchoring Phenomena Driving Question:** How can forces change the motion of objects on the playground?

### *Objects and Motion*

*Investigative Phenomena:*

How do balanced and unbalanced forces affect objects?

*Everyday Phenomena:*

Changing the height, mass, or distance of an object affects its motion.

We can test the effects of forces on objects.



### *Electric and Magnetic Forces*

*Investigative Phenomena:*

How do magnets interact with each other?

*Everyday Phenomena:*

Magnetic forces and static electricity cause objects to repel and attract from a distance.

We can use magnets to move a toy car around a race track.



PHENOMENA SEGMENT 2  
Life Cycles of Survival

# 3rd grade



**Mission Story:** The students learn that honeybee populations have declined drastically in the past few years. While some people only think of bees as stinging pests, they are very important to the environment. After watching a video, the students create a public service announcement (PSA) to inform the public on bees in various stages of their life cycle, how they help the environment, and how students can help protect the honeybee population.

**Anchoring Event:** A plant is growing underneath a tree.

The students view a video of a plant growing under a tree, then participate in a teacher-led discussion about the plant's life cycle as it grows from a seedling. The teacher generalizes the discussion to animal and insect life cycles and inherited traits, guiding the discussion toward bees and how they help the environment.

**Anchoring Phenomena Driving Question:** How do bees help the environment?

## Life Cycles

*Investigative Phenomena:*

What do plants and animals have in common?

*Everyday Phenomena:*

Different plants have similarities.

There are stages in a mealworm's life cycle.

We can model plant and animal life cycles.

Both plant and animal life cycles are divided into stages.

## Inheritance and Variation of Traits

*Investigative Phenomena:*

Why do offspring look similar but not exactly like their parents?

*Everyday Phenomena:*

A plant offspring inherits traits.

A puppy offspring inherits traits.

Differences exist within the same species of insect.

## Social and Group Behavior

*Investigative Phenomena:*

How can living in a group help or hurt an animal's survival?

*Everyday Phenomena:*

Hunting in a group can help the group gather more food.

Living in a group provides protection.

## Survival of the Fittest

*Investigative Phenomena:*

What are the benefits of variations within a species?

*Everyday Phenomena:*

Traits can vary in different ways.

Variations help species survive, find mates, and reproduce.

# 3rd grade

## PHENOMENA SEGMENT 3

### Surviving in Different Environments

**Mission Story:** The students are working with a conservation group to save an aquatic species from extinction. They will design an aquarium to hold sea urchins. The aquarium should provide for all the needs of the sea urchins, including food and shelter, and mimic their natural environment. The students' budget is \$200.

**Anchoring Event:** An octopus changes colors while hiding.

The students begin by viewing a video of an octopus changing colors when hiding. They participate in a teacher-led discussion about survival traits, and how an environmental change could affect the octopus. The teacher guides the discussion toward how an animal adapts to survive in a new or changed environment.

**Anchoring Phenomena Driving Question:** How does a changing environment affect organisms?



#### *Environmental Traits*

*Investigative Phenomena:*

How can the environment affect an organism's traits?

*Everyday Phenomena:*

There are differences between environmental and inherited traits.

We can identify examples of inherited and environmental traits.

#### *Environmental Changes and Effects*

*Investigative Phenomena:*

What happens to plants and animals when their environment changes?

*Everyday Phenomena:*

A fire, flood, or building a highway all affect the environment.

There are solutions to help organisms survive after an environmental change.

#### *Adaptations*

*Investigative Phenomena:*

Why do plants and animals live in certain places?

*Everyday Phenomena:*

An animal's traits determine the environment in which it lives to survive the best.

Humans can design habitats to meet the needs of animals.

#### *Fossils*

*Investigative Phenomena:*

Why are fossils sometimes found in places that don't make sense?

*Everyday Phenomena:*

Fossils are found in different environments.

Fossils give us information about the past.

#### *Plant and Animal Extinction*

*Investigative Phenomena:*

Why do organisms become extinct?

*Everyday Phenomena:*

Invasive plant species can have an impact on their environment.

Overhunting can cause the extinction of a plant or animal.

Paleontologists can study fossils to determine characteristics of extinct species.





PHENOMENA SEGMENT 4  
Weather Impacts

# 3rd grade

**Mission Story:** The students are part of the rapid-response news crew that reports the weather, makes predictions about next week's weather, and educates the public about being prepared for tornadoes. The students will create a news broadcast of local weather that includes predictions about upcoming weather and a segment on tornado safety.

**Anchoring Event:** A groundhog monitors its surroundings.

*The students begin by viewing a video of a groundhog monitoring its surroundings. They participate in a teacher-led discussion about how the groundhog makes observations to collect data, much like scientists collect data to predict weather. The teacher guides the discussion toward major weather events and what information the community needs to help prepare for high-risk weather.*

**Anchoring Phenomena Driving Question:** How can we prepare for hazards by studying patterns in weather?

## *Weather and Climate*

*Investigative Phenomena:*

How can we make predictions about the weather?

*Everyday Phenomena:*

Weather conditions for cities located in different areas of the United States are similar and different.

There is a difference between weather and climate.

Meteorologists have responsibilities.

Climates in Singapore and Washington, DC can be compared.



## *Processes and Impacts of Natural Hazards*

*Investigative Phenomena:*

How do we protect ourselves from hazardous weather?

*Everyday Phenomena:*

Natural hazards affect our homes.

New Orleans can be protected from rising water.



# 4th grade

## PHENOMENA SEGMENT 1

### Car Crashes

**Mission Story:** The student has gotten a job in the race car division of the ALI Car Company. They will consider current safety features and then design a new feature to lessen the impact of energy transferred during a crash, which will increase the chance of survival for the driver.

**Anchoring Event:** Solar energy transforms into wind energy.

The students view a video of solar energy being transformed into wind energy, then participate in a teacher-led discussion about how energy is transferred from one source to another. The teacher guides the discussion toward collision as another example of energy transformation, and then to what happens to energy during a car crash.

**Anchoring Phenomena Driving Question:** What happens to energy during a car crash?

#### *Energy and Speed*

*Investigative Phenomena:*

How is the speed of a moving object related to the energy it has to transfer to another object?

*Everyday Phenomena:*

The height of a ramp affects the distance an object will travel.

We can make objects move faster or slower.

#### *Transfer of Energy in Collision*

*Investigative Phenomena:*

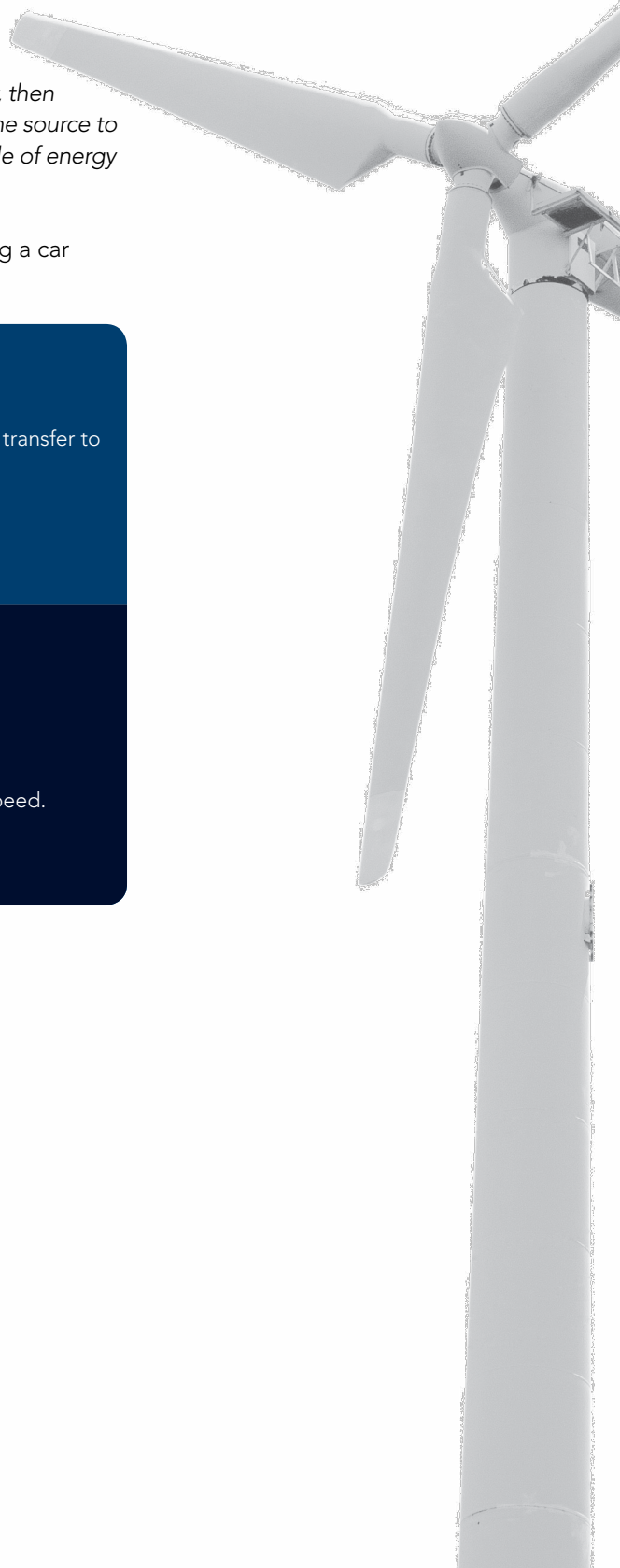
How is energy transferred when objects collide with one another?

*Everyday Phenomena:*

Different things happen when cars collide at different angles and speed.

The amount of energy transferred to an object is related to weight.

We can create different energy transfers.



PHENOMENA SEGMENT 2  
Renewable Energy

# 4th grade

**Mission Story:** The students work for a company that makes camping equipment. They have been asked to design a spinning system that can be attached to a generator and can power a hot plate. The system must use a renewable resource, and must not pollute the environment.

**Anchoring Event:** A dam converts the movement of water into energy.

*The students begin by viewing a video of a dam, then participate in a teacher-led discussion about how the dam collects, stores, and transfers energy using the renewable resource of water and its collision with turbine blades. The teacher guides the discussion toward using other natural and renewable resources to run cars and power devices.*

**Anchoring Phenomena Driving Question:** How do we get electricity and fuel to run cars and power electronic devices using renewable resources?

## *Using Stored Energy*



*Investigative Phenomena:*

How is stored energy used?

*Everyday Phenomena:*

Stored energy is used in everyday life.

Energy is converted for different types of transportation.

## *Renewable and Nonrenewable Resources*



*Investigative Phenomena:*

We use energy for many things, such as fueling our cars and lighting our cities. Where do we get the majority of our energy from?

*Everyday Phenomena:*

We can classify natural resources.

Different types of energy use have different effects.

There are sources of energy other than fossil fuels.

## *Energy Transfer and Electric Currents*



*Investigative Phenomena:*

How does energy move from one place to another?

*Everyday Phenomena:*

A battery can cause a buzzer to sound.

We can convert stored energy into many different types of energy.

Electric currents and energy transfer are important.

# 4th grade

## PHENOMENA SEGMENT 3 Sculpting Landscapes

**Mission Story:** The students work for an animation company that is creating an app that simulates landscapes being sculpted by different events. In the app, students may pick the event and see how a section of rock changes. (The rock is shown on the Mission Log.) The students will create illustrations to show how rock layers could change based on different events.

**Anchoring Event:** A person ages on a time-lapse video.

The students begin by viewing a time-lapse video of a person's face aging. They participate in a teacher-led discussion about how some features of a face are changed by forces as it ages like the Earth's surface. The teacher guides the discussion toward the types of changes to Earth's surface that have occurred over time and why those changes have occurred.

**Anchoring Phenomena Driving Question:** How have events changed Earth's landscape?

### *Rock Patterns*

*Investigative Phenomena:*

If environments change so slowly, how can we know what they used to be like?

*Everyday Phenomena:*

Fossil evidence can tell us about the kinds of events that affect the layers of Earth.

Earthquakes cause changes in the patterns of rock formations.

### *Changing Land*

*Investigative Phenomena:*

How do landforms change over time?

*Everyday Phenomena:*

Waves have effects on beaches.

Processes change Earth's surface.

The slope of the land affects the rate of water erosion.

There are different agents of weathering and erosion.

### *Plate Tectonics*

*Investigative Phenomena:*

What causes the patterns of Earth's features?

*Everyday Phenomena:*

There are connections between tectonic plates and the location of certain landforms.

Plate movement results in different landforms on Earth.

Most volcanoes and earthquakes occur in certain locations.

### *Natural Processes*

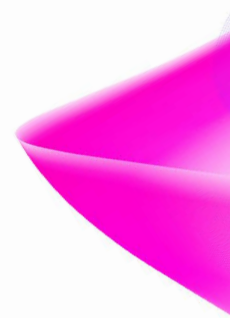
*Investigative Phenomena:*

How can we reduce the impacts of natural Earth processes on humans?

*Everyday Phenomena:*

The impact of earthquakes, floods, tsunamis, and volcanic eruptions can be reduced.

People can protect an island from the impact of volcanoes, earthquakes, and tsunamis.



PHENOMENA SEGMENT 4  
**Earthquake Engineering**

# 4th grade

**Mission Story:** The students are building their first home in California, and they have to decide where they want to live. The distance of the possible areas from fault lines determines the cost of the land and the materials that will be used to build the home. How will the students decide where they want to live?

**Anchoring Event:** There is a pattern to waves in the ocean.

*The students view a video of ocean waves, then participate in a teacher-led discussion about how ocean waves have patterns like sound, seismic, and light waves, and the similarity of ocean waves to the waves that cause earthquakes. The teacher guides the discussion to the impact of earthquakes and where they are the strongest.*

**Anchoring Phenomena Driving Question:** Where are the impacts of earthquakes the strongest?

## *Wavelength and Amplitude*

*Investigative Phenomena:*

How do amplitude and wavelength affect the motion of objects?

*Everyday Phenomena:*

Patterns in waves can be observed.

We can change the patterns of waves in water.

An earthquake's wavelength and amplitude can be recorded.



## *Motion of Waves*

*Investigative Phenomena:*

How do waves cause objects to move?

*Everyday Phenomena:*

Waves can be created and show patterns.



# 4th grade

## PHENOMENA SEGMENT 5 Animal Senses

**Mission Story:** The students work for a science museum, studying fossils. Paleontologists have discovered a skeleton in the desert that they are unable to identify. The students are asked to determine what this animal might have looked like and how it lived.

**Anchoring Event:** A pupil is dilating.

The students begin by viewing a video of the pupil of an eye dilating. They participate in a teacher-led discussion about how the pupil changes as it senses light and how such sense receptors help animals survive. The teacher guides the discussion toward how studying the physical characteristics shown in fossils can tell us about extinct animals and the environments they lived in.

**Anchoring Phenomena Driving Question:** How can we use fossils to help determine the physical characteristics of extinct animals and the environments they lived in?

### *Sense Receptors*

*Investigative Phenomena:*

How do the senses help organisms respond to different things?

*Everyday Phenomena:*

Different forms of communication help animals survive.

Animals sense and respond to danger.

### *Plant and Animal Parts*

*Investigative Phenomena:*

What do an animal's unique parts have to do with its survival?

*Everyday Phenomena:*

Plants have different parts and structures.

Our internal body structures interact to help us survive.

Physical traits support an organism's ability to survive, grow, and reproduce.

### *Light Reflection*

*Investigative Phenomena:*

How are we able to see things?

*Everyday Phenomena:*

We can change the direction of light reflection.

Light reflects to allow us to see objects in a box.

We can use light reflection to see an object behind a wall.

### *Information Technologies*

*Investigative Phenomena:*

What kinds of communication technology are used in everyday life?

*Everyday Phenomena:*

Different types of codes to communicate can be compared to each other.

Information is transferred using various types of technology.

We can create a code that has never been used before.





# 5th grade

## PHENOMENA SEGMENT 1 What Is Matter Made Of?

**Mission Story:** The students live where a tsunami has hit the coast of California. They are on a disaster relief team in charge of developing an action plan to reopen the plant that provides clean drinking water to many cities. The plant has no electricity, contaminants in the water supply, and damage to concrete around the water tanks.

**Anchoring Event:** A sugar cube dissolves in tea.

The students will begin by viewing a video of a sugar cube dissolving in tea. They will participate in a teacher-led discussion about whether the sugar is still there, even though we cannot see it. The teacher should then guide the discussion to determine how we can use the properties of matter to clean up water after a natural disaster.

**Anchoring Phenomena Driving Question:** How can we use the properties of matter to clean up water after a natural disaster?

### *Matter Is Everywhere*

*Investigative Phenomena:*

How do we know matter exists, even if it cannot be seen?

*Everyday Phenomena:*

Different things happen when substances dissolve.

We can find out if something that we cannot see is still in the water.

### *Changes to Matter*

*Investigative Phenomena:*

Can matter just disappear?

*Everyday Phenomena:*

We can measure whether weight changes in materials as they melt.

We can conduct an investigation to find out if weight of materials stays the same when they are mixed.

Chemical reactions can be observed to find out if the weight of the materials changes during the reaction.

### *Properties of Matter*

*Investigative Phenomena:*

How can we identify an unknown substance?

*Everyday Phenomena:*

Conductors allow electrical energy to move through them.

Some materials will dissolve in water.

Materials can be sorted by their properties.

### *Mixtures*

*Investigative Phenomena:*

Do we ever create new substances?

*Everyday Phenomena:*

Signs can be observed to determine if a chemical reaction has occurred.

Mixing substances may or may not create a new substance.

Different things occur when we mix different substances.





PHENOMENA SEGMENT 2  
From Matter to Organisms

# 5th grade

**Mission Story:** The students are part of a team who will be colonizing Mars. Their job is to design a closed system to grow plants with limited resources, including water, soil, and nutrients. The students need to keep in mind there is no water available on the planet and the air on Mars is very different from the air on Earth.

**Anchoring Event:** People are at an aquarium.

The students view a video of people at an aquarium, then discuss how the aquarium is an ecosystem where Earth's air and water interact, and where matter and energy are transferred. The teacher guides the discussion toward what people need to survive and how a system might be developed to help sustain plant and human life on another planet.

**Anchoring Phenomena Driving Question:** How can we develop a system to help grow and sustain plant and human life on a foreign planet?



### *Matter and Energy in Plants*

*Investigative Phenomena:*

How do plants keep growing bigger?

*Everyday Phenomena:*

Plants grow with water, air, and other things.



### *Food Webs*

*Investigative Phenomena:*

Do all organisms eat plants?

*Everyday Phenomena:*

Organisms get their energy from different things.

Different processes affect compost piles.



### *Ecosystems*

*Investigative Phenomena:*

How do organisms interact with the nonliving things in their environment?

*Everyday Phenomena:*

An animal's habitat helps meet its needs.

Population size of groups can cause things to happen.

Animals can hurt an ecosystem.



### *Matter Cycles*

*Investigative Phenomena:*

Can plants live without air?

*Everyday Phenomena:*

Matter moves in certain ways.

We can reduce the amount of trash we throw away.



### *Energy Transfer*

*Investigative Phenomena:*

Other than for heat, how do animals depend on the Sun?

*Everyday Phenomena:*

Depriving a plant of sunlight can reduce the quality of food it produces.

Energy moves in an ecosystem.



### *Earth's Systems Interactions*

*Investigative Phenomena:*

How do the organisms, land, air, and water interact in an environment?

*Everyday Phenomena:*

Earth's four spheres have characteristics.

There is a relationship between the atmosphere, biosphere, geosphere, and hydrosphere.

Earth's spheres interact and we can model those interactions.

# 5th grade

## PHENOMENA SEGMENT 3 Interacting Earth's Systems

**Mission Story:** The students have learned that the Industrial Revolution, which started in the late 1700s, changed human lives through the use of machines for manufacturing things quickly. However, Earth suffered from this progress. The students will argue in favor of a group of time travelers being sent back to warn others about the negative effects and suggest solutions, so technological advances can still happen without damaging Earth.

**Anchoring Event:** Trash on the beach.

The students begin by viewing a video of trash being washed into the ocean from a beach. They participate in a teacher-led discussion about the impact of trash on the planet's systems. The teacher should then generalize the discussion toward the human impact on Earth's systems and how it might be diminished.

**Anchoring Phenomena Driving Question:** How are Earth's systems affected by humans?

### *Water Sources*

*Investigative Phenomena:*

How much of Earth's surface is covered by water?

*Everyday Phenomena:*

Earth's water is located in specific places.

A portion of Earth's water is accessible for use.

### *Reducing the Human Footprint*

*Investigative Phenomena:*

How do our actions affect the environment, and what can we do to reduce those effects?

*Everyday Phenomena:*

Farming affects the water and soil.

There are effects of acid rain.

Our community works to prevent and reduce pollution.

We can clean up Earth's outer atmosphere.



PHENOMENA SEGMENT 4  
**Patterns in the Night Sky**

# 5th grade

**Mission Story:** The students are the producers of a new show called Surviving the Wild. They need to make a survival guide to help the contestants on the show. They will use the information they gather through their mission to create the guide and help the contestants survive in the wild!

**Anchoring Event:** Saturn and one of its moons, Titan, orbit in space.

The students first view a video of Saturn and its moon, then discuss the patterns we observe when they interact. The teacher guides the discussion toward how we can use patterns on Earth and in the sky to help us solve problems.

**Anchoring Phenomena Driving Question:** Can we use patterns on Earth to help us solve problems?



## *Gravity*

*Investigative Phenomena:*

Why is the direction of gravity downward toward Earth?

*Everyday Phenomena:*

Earth's gravitational pull has many effects.



## *Earth's Rotation*

*Investigative Phenomena:*

What patterns does Earth's movement cause?

*Everyday Phenomena:*

Shadows change throughout the day.

The hours of daylight vary throughout the seasons.



## *Observing the Stars*

*Investigative Phenomena:*

If the Sun is an average star, why does it look like the largest?

*Everyday Phenomena:*

Some stars are closer to Earth than others.



## *Objects in the Sky*

*Investigative Phenomena:*

Why do objects in the sky move and change so much?

*Everyday Phenomena:*

The appearance of the moon changes as it revolves around Earth.

There are specific constellations that can be seen in certain locations during the year.

There are differences in the length of day and night throughout the year.



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