Unit Map

How can the kids in Mariposa Grove attract monarch caterpillars to their neighborhood?

Students take on the role of scientists in order to figure out why no monarch caterpillars live in the area that was converted from a field to a community vegetable garden. They investigate how plants and animals get what they need to live and grow, and then they make a new plan for the garden that will provide for the needs of monarch caterpillars and produce vegetables for humans.

Chapter 1: Why are there no monarch caterpillars since the Field was made into the Garden?

Students figure out: Last year, the Field was a place where monarch caterpillars could live because it had milkweed for them to eat. Now that it is a Garden, there are no monarch caterpillars. The caterpillars cannot live in the Garden because the milkweed they need to eat is not there.

How they figure it out: Students learn to make multisensory observations as they go on a science walk to figure out what things live in the neighborhood. By investigating photos of animals eating and animals in their habitats, students construct the idea that animals can only live in a place that has the food they need. They observe and compare two images of Mariposa Grove and its plants—one from a year ago when it was the Field and one taken since it became the Garden. Finally, the class co-constructs an explanation for why monarch caterpillars no longer live in the Garden.

Chapter 2: Why did two milkweed seeds become plants, but the other did not?

Students figure out: Ms. Ray planted milkweed seeds in three pots, but nothing grew in one pot. The milkweed seed in that pot did not grow because it did not get water. Plants need water to grow, and they get water from the soil around them by using their roots.

How they figure it out: Students watch time-lapse videos in order to investigate what happens when plants grow. They also observe and record the growth of radish seeds and sprouting garlic plants. Students discover different ways to measure the growth of plants. They figure out that plant growth means a plant is getting bigger or adding parts that were not there before. By observing what happens to plants that do and don't have water, students can explain that plants need water.

Chapter 3: Why do the milkweed plants that get water grow differently?

Students figure out: Two of Ms. Ray's milkweed pots got water, and the seeds in those pots grew. However, the plants grew differently from each other. One plant grew more because it got the light it needed, but the other plant grew less because it did not get the light it needed. Plants need light to live and grow, and they get light with their leaves.

How they figure it out: Students investigate a picture of milkweed plants and observe that a plant in the shade did not grow well even though it had water. They plan an investigation to determine whether plants need light to live. Students then measure the growth of sunflower plants that grew in the light versus those that didn't, and they watch time-lapse videos of plants growing in the dark. Students explain why plants may not grow well even when they get water.

Chapter 4: How can humans make sure that other living things will be able to live and grow?

Students figure out: Monarch caterpillars must eat milkweed plants as they grow into monarch butterflies. Humans also need food, but they can grow the food they need. Sometimes when humans grow food, they get rid of certain plants, which might be food for other animals. This is what happened in the Garden. If humans plan a garden that has vegetables and milkweed plants, both humans and monarch caterpillars will get the food they need.

How they figure it out: Students read a book about butterfly scientists in Mexico who used what they learned through investigation to encourage people to restore the habitats of monarch caterpillars and butterflies. Students explore photos to learn ways that humans depend on plants. They design a solution to the problem by planning a garden that can meet the needs of both humans and monarchs.

Unit Map

How can we create a pinball machine for our class?

Students take on the role of pinball engineers as they investigate the effects of forces on the motion of an object. They test their own prototypes (models) of a pinball machine and use what they learn to contribute to the design of a class pinball machine. Over the course of the unit, students construct a foundational understanding of why things move in different ways.

Chapter 1: How do we make a pinball start to move?

Students figure out: To make our pinball start to move, we must exert a force on the pinball. We can use a rubber band launcher to exert a force on the pinball.

How they figure it out: Students investigate how to make objects in the classroom start to move. They talk about cause and effect, read a book that introduces key scientific language and use it to practice talking about forces and observed motion. Finally, students create models for testing their ideas about making the pinball start to move.

Chapter 2: How do we make a pinball move as far as we want?

Students figure out: To make our pinball go the distance we want, the rubber band launcher has to exert a strong force. To make it go a short distance, the rubber band launcher has to exert a gentle force. Attaching a shoelace to the rubber band launcher can help us adjust the force.

How they figure it out: Students investigate how to make a pinball move short or long distances by testing their ideas in the Box Models. They describe how the launcher can be used to exert gentle and strong forces to move a pinball different distances.

Chapter 3: How do we make a pinball move to a certain place?

Students figure out: To get the pinball moving in the direction we want (left or right), we must exert a force on the pinball in the direction that we want it to move.

How they figure it out: Students investigate how to control the pinball's direction of movement by controlling the direction of applied forces. They read to obtain information from a book on building with forces and use this language to talk about forces moving in a particular direction.

Chapter 4: How do we make a moving pinball change direction?

Students figure out: To make a moving pinball change direction, we have to exert another force on it, either from a moving object or from a still object in its path.

How they figure it out: Students investigate how to change the direction of a moving pinball. Ultimately, the class decides whether and how to add flippers, targets, and a bumper to the Class Pinball Machine and use Explanation Language Frames to help them discuss and write about how forces cause a moving object to change direction.

Chapter 5: How can we make the pinball machine do all the things we want it to do?

Students figure out: As pinball engineers, we plan, make, test, and modify our designs based on what we learn. In our pinball machine, forces from the rubber band launcher make the ball start moving in the direction and over the distance we want, and forces from blocks and flippers cause the pinball to change direction.

How they figure it out: Students create and then improve a pinball machine, first on their own in their Box Models and then in the Class Pinball Machine. Students draw their plans and write a mini-book to explain what they have learned.

Chapter 6: Where are forces around us?

Students figure out: There are strong and gentle forces in different directions all around us. We know a force has been exerted on an object whenever that object starts moving, changes direction, or stops moving.

How they figure it out: Students tour their school to identify evidence of forces. Then students read and discuss a book that shows forces at work in the world.

Unit Map

Why are the playgrounds at two schools different temperatures? Why does one playground flood?

The students at Woodland and Carver Elementary schools are not comfortable outside during their recess times. The Carver students are too cold in the morning, and the Woodland students are too hot in the afternoon. The school principals need student weather scientists to help them explain the difference in playground temperatures. Students gather data from models of the sun and of Earth's surface and observe their own playgrounds to figure out how sunlight causes changes in the temperature of different surfaces. Students then use models to figure out why Woodland's playground sometimes floods.

Chapter 1: What is the weather like on the playgrounds?

Students figure out: The weather at Carver Elementary and Woodland Elementary is similar. Both schools have many sunny days and some cloudy, windy, or rainy days. The type of weather at each school must not be causing the difference in their playgrounds' temperatures.

How they figure it out: Students learn to describe types of weather, then observe and record the weather at their own school. They read a book that helps them describe temperature and use thermometers to take measurements. Students then construct graphs to analyze weather data from each school.

Chapter 2: Why do the playgrounds get warm?

Students figure out: The surfaces of the playgrounds get warm because sunlight shines on their surfaces during the day.

How they figure it out: Students use models of the sun and of Earth's surface to measure the temperature of a surface when light is and is not shining on it. Students read about models and how scientists use them. Students measure the temperature of their own playground surface in sunlight and in shade and they act out how sunlight shining on a surface makes the surface warmer.

Chapter 3: Why are the playgrounds warmer in the afternoon?

Students figure out: The playgrounds at both schools are warmer in the afternoon than in the morning because sunlight has been shining on the surfaces for a longer time.

How they figure it out: Students use models to measure the temperature of a surface as light shines on it for different lengths of time. They analyze morning and afternoon temperature data from their own playground and act out how sunlight shining on a surface over time makes it get warmer and warmer.

Chapter 4: Why is Woodland Elementary School's playground always warmer during recess?

Students figure out: Woodland Elementary's playground has a darker surface than Carver Elementary's playground. Woodland's playground is warmer because dark surfaces get warmer than pale surfaces when the sun shines on them.

How they figure it out: Students use models to measure the temperature of dark and pale surfaces as light shines on them. Students also read a book about a lizard who travels to different surfaces throughout the day. Students compare the temperatures of pale and dark surfaces on their own playgrounds and evaluate how possible solutions would affect the temperature on each playground.

Chapter 5: Why does only Woodland Elementary School's playground flood?

Students figure out: Woodland's playground floods after severe rain because it has a solid surface that does not absorb water, while Carver's playground has a gravel surface that rainwater can soak into.

How they figure it out: Students use models to test four differences between the two playgrounds that could cause flooding. They evaluate solutions that would help Woodland prepare for severe rain in the future and create posters describing preparations for other kinds of severe weather.