Mystery science

Anchor Layer Teacher Guide

A curriculum companion for Anchor Layer users

Grade 2

Plant Growth & Interactions

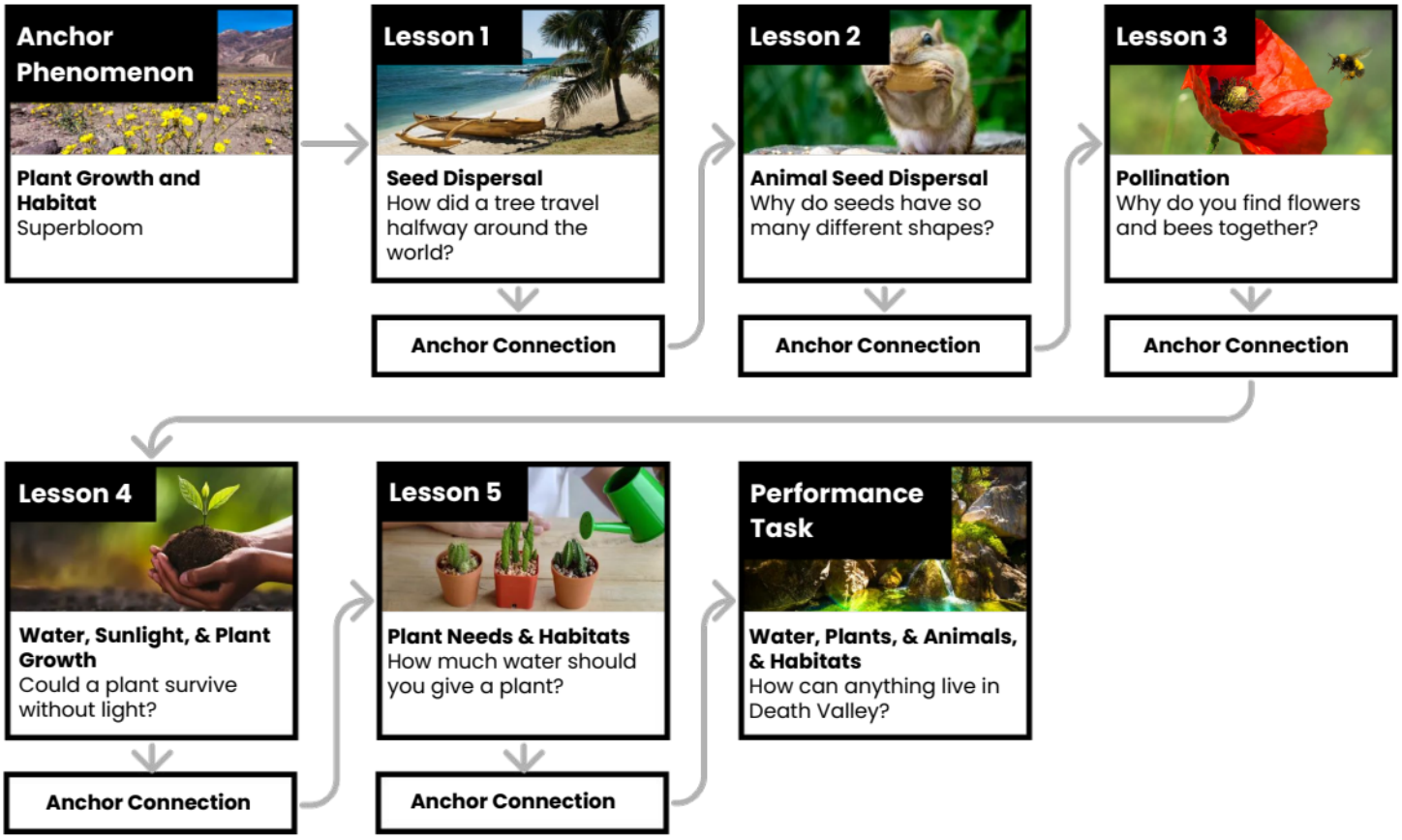
Unit Web Link • Pacing Guide • Other Units



Unit Summary

In this unit, students explore how plants interact with the environment to meet their needs. Students build models of seeds to explore how and why plants disperse their seeds. Students also conduct hands-on investigations to determine what those seeds need in order to grow, and what the adult plants need in order to survive and thrive. Assessments

Performance Expectations	Science & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
• K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem. • 2-LS2-1. Plan and conduct an investigation to determine if plants need sunlight and water to grow. • 2-LS2-2. Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.	• Developing and Using Models • Planning and Carrying Out Investigations • Analyzing and Interpreting Data	• LS2.A: Interdependent Relationships in Ecosystems	• Structure and Function • Cause and Effect



Anchor Phenomenon Background



How can fields of flowers grow in one of the hottest, driest places on Earth?

Death Valley is an incredible place. Located in California, USA, it is a place of extremes. It is one of the hottest and driest places anywhere in the world. In the summer months, the average high temperature each day is a blistering 114°F (46° C), and the average annual rainfall is just 1.94 inches (4.9 cm).

Despite these harsh conditions, a wide variety of plants and animals inhabit the area. They have adapted to live in an environment with a scarcity of water and an overabundance of heat and light.

Approximately once every ten years, though, Death Valley experiences a slight reprieve. It is rare, but in some winters, Death Valley receives a series of multiple gentle rainstorms. These gentle rain storms soak into the dry earth, and millions of tiny wildflower seeds begin to germinate. This is the beginning of one of the most amazing phenomena seen in any desert: a superbloom!

The conditions that lead to a superbloom are very rare. There has to be enough water from winter rain storms for the seeds to begin to grow. They eventually begin growing in the spring, and the new plants are in a race to produce flowers and new seeds before the Sun builds in intensity and inevitably dries the flowers up. The flowers can suddenly appear, completely covering areas that were barren sand and rock just a few months prior, and then disappear within just a few weeks.

When the flowers dry up and disappear, however, they leave their seeds behind. Those seeds then lie dormant for years, until the conditions are just right for the superbloom cycle to repeat!

Anchor Phenomenon: Superbloom
Plant Growth and Habitat



Anchor Phenomenon
25 mins

Guided Inquiry
25 mins

Hands-On Activity
25 mins

Anchor Phenomenon Lesson Overview

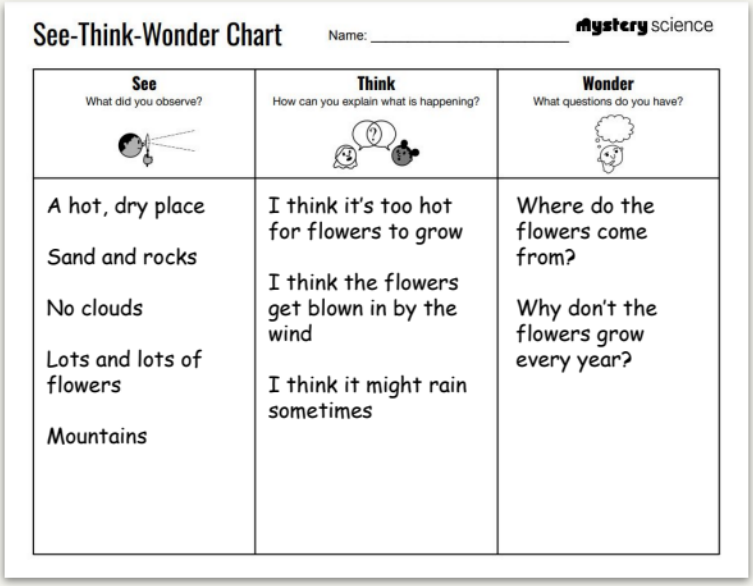
Note: This lesson is part of this unit's Anchor Layer. If you have the Anchor Layer turned on, we recommend teaching all lessons in the remainder of this unit in order.

The anchor phenomenon for this unit is an amazing burst of life in a place called Death Valley. How can huge fields of flowers suddenly grow in one of the hottest, driest places on Earth?

During the introduction, students generate observations and questions about the phenomenon and create an initial conceptual model to explain the phenomenon. You can split this introduction into two parts with a break in between: complete everything up through the See-Think-Wonder, and then complete everything after that point. Students will use these initial ideas to track how their understanding grows throughout the unit.

Student Work Samples & Notes

Students will gather clues during and after each lesson in this unit to help them improve their understanding and explanations. It is important to encourage students to recognize that even if they don't know the perfect answer yet, they are going to learn a lot throughout the unit and will have an opportunity to revisit the phenomenon over time.



See-Think-Wonder Chart

Name: _____

Mystery science

See What did you observe?	Think How can you explain what is happening?	Wonder What questions do you have?
A hot, dry place Sand and rocks No clouds Lots and lots of flowers Mountains	I think it's too hot for flowers to grow I think the flowers get blown in by the wind I think it might rain sometimes	Where do the flowers come from? Why don't the flowers grow every year?

Lesson 1: How did a tree travel halfway around the world?
Seed Dispersal (pg 1 of 2)



Exploration
10 mins

Hands-On Activity
35 mins

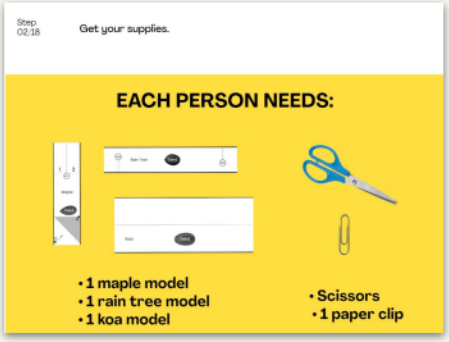
Wrap-Up
10 mins

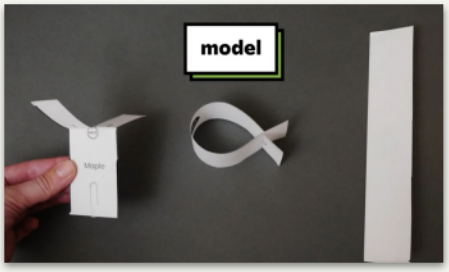
Anchor Connection
20 mins

Overview

In this lesson, students investigate the mystery of the koa tree, a type of tree that grows in only two places—islands halfway across the world from one another.

In the activity, students develop three different physical models of seed structures. They observe how structure affects the seed's function in dispersing away from the tree. Then, they use these observations to evaluate whether koa seeds are likely dispersed by wind, water, or animals.





Activity Notes

You and your students may notice that the seed models don't look exactly like the real seed structures. The models may look different than the real things, but they should mimic the function of how the real seeds fall and float to the ground.

We suggest students work in pairs. Each student will make their own seed models, but having a partner is useful for discussion and testing during the activity.

Each of the printouts has multiple seed models. We suggest cutting these seed models ahead of time for your students. Using a paper cutter can make this prep go quickly.

Anchor Connection on Next Page

Lesson 1: How did a tree travel halfway around the world?
Seed Dispersal (pg 2 of 2)



Exploration
10 mins

Hands-On Activity
35 mins

Wrap-Up
10 mins

Anchor Connection
20 mins

Anchor Connection

Many plants produce seeds. Seeds can grow and produce new plants. The seeds in Death Valley are tiny, but they are important! Even though the seeds are too tiny to be seen in any of the images that students have viewed, they are there, waiting to grow and become superblooms. The plants that grow in a given superbloom continue the cycle: they produce new seeds that will eventually become the next superbloom.

Students revisit the worksheet that they worked on during the Anchor Phenomenon. They should understand that the flowers don't come out of nowhere—they grow from seeds. The seeds for each superbloom come from the previous superbloom.

Students may add to their worksheet by drawing seeds on the ground in the non-superbloom image, drawing seeds falling from the flowers in the superbloom image, and by adding in words/labels as is applicable for their ability level.

Connecting Storyline Question

Why do the seeds sit for so long without growing?

Lesson 2: Why do seeds have so many different shapes?
Animal Seed Dispersal (pg 1 of 2)



Exploration
15 mins

Hands-On Activity
30 mins

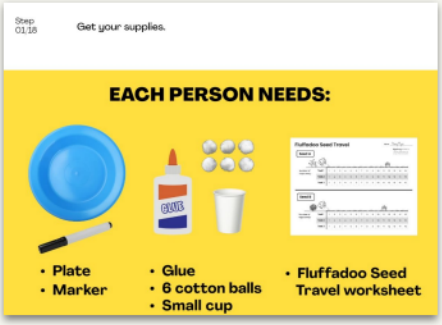
Wrap-Up
15 mins

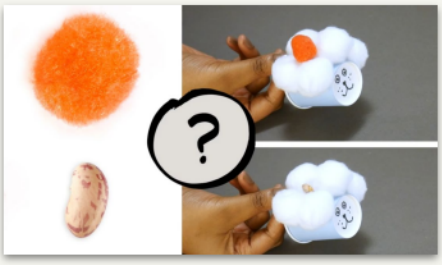
Anchor Connection
20 mins

Overview

In this lesson, students explore how the structures of seeds enable them to disperse, with a focus on seeds that utilize animal structures to aid in their dispersal.

In the activity, Seed Travelers, students develop a model of a furry animal ("fluffadoo") and then use it to test how far seed models with different structures can travel.





Activity Notes

We suggest students work in pairs for the activity. Separate materials for distribution. Seed A (pompom) is distributed in Step 7 and Seed B (bean) is distributed in Step 14.

Make sure students have space to hop up and down in place when doing fluffadoo + seed model tests. Seed A should stay on the fluffadoo the longest. Oftentimes, it can stay attached until the maximum of 15 hops. Seed B should fall off of the fluffadoo almost immediately- usually within 1 or 2 hops. See our lesson page for troubleshooting options.

As an accessibility accommodation, instead of hopping in place, students can test their fluffadoo + seed by raising and lowering their arms while seated (mimicking the motion of a hopping fluffadoo).

Anchor Connection on Next Page

Lesson 2: Why do seeds have so many different shapes?
Animal Seed Dispersal (pg 2 of 2)



Exploration
15 mins

Hands-On Activity
30 mins

Wrap-Up
15 mins

Anchor Connection
20 mins

Anchor Connection

Seeds have plenty of room to grow in Death Valley, but seeds won't begin to grow unless they are exposed to water. This explains why seeds can remain dormant in Death Valley for so many years. It is rare for there to be enough rain in Death Valley for the seeds to grow. When it does rain, the seeds spring to life!

Students revisit the worksheet that they worked on during the Anchor Phenomenon. They should understand that seeds begin growing when they are exposed to enough water. It is very, very rare for it to rain enough in Death Valley for a superbloom.

Students may add to their worksheet by drawing pictures and/or writing words to show that it must rain before a superbloom in order for the seeds to begin growing.

Connecting Storyline Question

What else do the plants need to be able to grow?

Lesson 3: Why do you find flowers and bees together?
Animal Seed Dispersal (pg 1 of 2)



Exploration
10 mins

Hands-On Activity
35 mins

Wrap-Up
10 mins

Anchor Connection
20 mins

Overview

n this lesson, students investigate the mystery of why bees tend to spend so much time in and around flowers.

In the activity, Busy Bees, students develop a model that mimics the function of an animal pollinating plants.



Activity Notes

We suggest students work in pairs. Homeschool students can work on their own, but will need to make two flower models and may need a partner to help with a few steps of the activity.

For further notes on how to prepare for the activity, see the lesson page.

Anchor Connection on Next Page

Lesson 3: Why do you find flowers and bees together?
Animal Seed Dispersal (pg 2 of 2)



Exploration
10 mins

Hands-On Activity
35 mins

Wrap-Up
10 mins

Anchor Connection
20 mins

Anchor Connection

Seeds have plenty of room to grow in Death Valley, but seeds won't begin to grow unless they are exposed to water. This explains why seeds can remain dormant in Death Valley for so many years. It is rare for there to be enough rain in Death Valley for the seeds to grow. When it does rain, the seeds spring to life!

Students revisit the worksheet that they worked on during the Anchor Phenomenon. They should understand that bees need to fly from flower to flower and pollinate them, for the flowers to make seeds.

Students may add to their worksheet by drawing pictures and/or writing words to show that it bees must pollinate flowers in order to produce seeds for the next superbloom.

Connecting Storyline Question

What else do the plants need to be able to grow?

Lesson 4: Could a plant survive without light? (pg 1 of 2)
Water, Sunlight, & Plant Growth



Exploration
18 mins

Hands-On Activity
40 mins

Wrap-Up
7 mins

Anchor Connection
15 mins

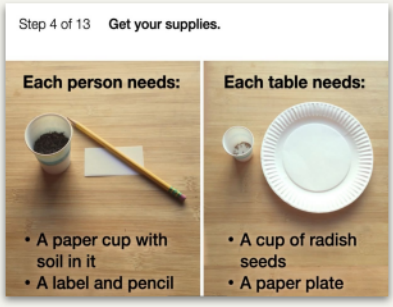
Assessment
20 mins

Overview

In this lesson, students investigate how plants need water and sunlight to grow.

In the two-part activity, Seeds — Light and Dark, students experiment with growing radish seeds in light and dark conditions. They plant them in cups, place half of the cups in sunlight, and put the other half in a dark container. Three to seven days later, students compare the seedlings and then watch what happens when all are placed in sunlight.





Activity Notes

This is a two-part activity. We recommend that you allow at least three days (up to one week) in between Part One and Part Two of the experiment to give the radish seeds time to germinate.

You will need access to a sunny windowsill for radish seeds to grow in the light. You will also need access to water so that you can fill up the spray bottles.

We suggest students work in pairs. For more detailed instructions on how to prep your seeds, cups, and spray bottles, see our lesson page.

Anchor Connection on Next Page

Lesson 4: Could a plant survive without light? (pg 2 of 2)
Water, Sunlight, & Plant Growth



Exploration
18 mins

Hands-On Activity
40 mins

Wrap-Up
7 mins

Anchor Connection
15 mins

Assessment
20 mins

Anchor Connection

While plants can grow in the dark, they can't do it for long without becoming sick. Light is a requirement for plants to fully grow and be healthy. Fortunately for plants in Death Valley, there is an abundance of sunlight.

Students revisit the worksheet that they worked on during the Anchor Phenomenon. They should understand that the plants also require sunlight to grow and be healthy. Fortunately, Death Valley has an abundance of sunlight.

Students may add to their worksheet by drawing pictures and/or writing words to show that sunlight is an important part of the superbloom cycle.

Connecting Storyline Question

Why do the flowers eventually dry up and disappear?

Lesson 5: How much water should you give a plant? (pg 1 of 2)
Plant Needs & Habitats



Exploration
15 mins

Hands-On Activity
30 mins

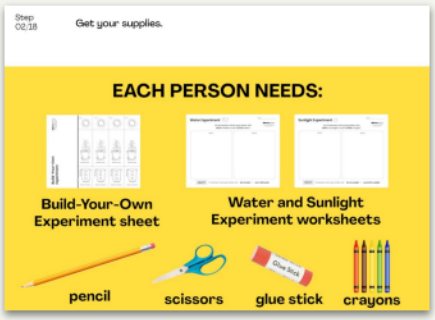
Wrap-Up
10 mins

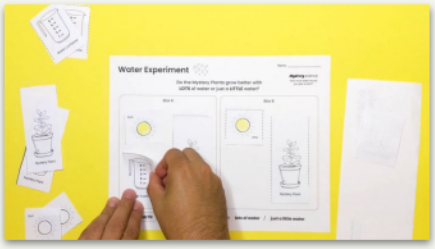
Anchor Connection
20 mins

Overview

In this lesson, students investigate how different plants grow best under very different conditions, ranging from deserts to tropical rainforests.

In the activity, Puzzling Plants, students plan and conduct virtual experiments in order to determine how much water and sunlight a set of mystery plants need to grow and stay healthy.





Activity Notes

We suggest students work in pairs to share ideas. This activity walks students through virtual experiments to help reinforce the concept that an experiment should only change one part (variable), but keep all the other parts the same (controls).

We think it's best to follow-up these learnings with a hands-on experiment that uses real plants! If you have radish plants leftover from the lesson "Could a plant survive without light?", you can guide your students to plan and conduct a few classroom experiments.

Anchor Connection on Next Page

Lesson 5: How much water should you give a plant? (pg 2 of 2)
Plant Needs & Habitats



Exploration
15 mins

Hands-On Activity
30 mins

Wrap-Up
10 mins

Anchor Connection
20 mins

Anchor Connection

All plants require water and light to grow and be healthy. Unfortunately, Death Valley is a place of extremes. No matter how good the conditions are for a superbloom, they don't last for long. After blooming for just a few weeks, there is just too much sunlight (which causes too much heat) and not enough water for the flowers to survive. They eventually dry up and crumble. The seeds they produced, however, sit in wait for the next time that conditions are just right!

Students revisit the worksheet that they worked on during the Anchor Phenomenon. They should understand that the flowers eventually dry up from too much sunlight and not enough water. Their seeds are left behind, though, waiting for the next time the rains come.

Students may add to their worksheet by writing words to explain that the flowers dry up because of too much heat/light and not enough water.

Connecting Storyline Question

What other living things need water in Death Valley?

Performance Task: How can anything live in Death Valley?
Water, Plants, & Animals, & Habitats

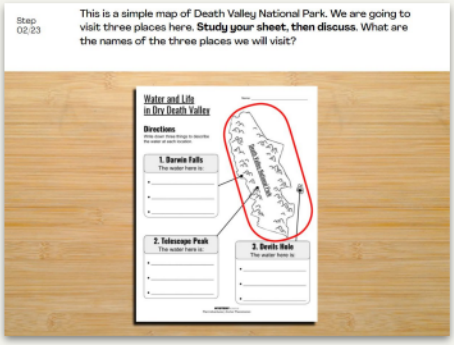


Unit Review
15 mins

Hands-On Activity
40 mins

Overview

In this performance task, students will obtain information about Death Valley in order to see how different living things make use of water in different forms and in different places.



Performance Task Notes

After a review of the Plant Adventures unit, students will virtually travel to different locations in Death Valley. They will make observations about how the water at each location supports a wide variety of incredible living things, ranging from one of the oldest living things on Earth to one of the rarest.

Crosscutting Concepts

Systems and System Models: A system is made up of a collection of interacting parts and processes. The extreme temperature and dryness in Death Valley ultimately control when and how many of the seeds can begin to grow and produce flowers. This interaction between the conditions in Death Valley and the living things that inhabit the area can be modeled as a cycle that is labeled with various words and drawings.

Cause and Effect: The environmental conditions in Death Valley are the causes that lead to the effects of huge numbers of flowers blooming—or not!