Mystery science

Anchor Layer Teacher Guide

A curriculum companion for Anchor Layer users

Grade 5

Ecosystems & The Food Web

Unit Web Link • Pacing Guide • Other Units

Unit Summary

In this unit, students explore how organisms depend on one another and form an interconnected ecosystem. Students investigate food chains, food webs, and the importance of producers, consumers, and decomposers. Assessments

Performance Expectations	Science & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
• 5-LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water. • 5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. • 5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment. • 5-PS3-1. Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.	• Planning and Carrying Out Investigations • Developing and Using Models • Obtaining, Evaluating, and Communicating Information • Constructing Explanations and Designing Solutions • Planning and Carrying Out Investigations • Analyzing and Interpreting Data	• LS2.A: Interdependent Relationships in Ecosystems • LS2.B: Cycles of Matter and Energy Transfer in Ecosystems • LS1.C. Organization for Matter and Energy Flow in Organisms • ESS3.C: Human Impacts on Earth Systems • PS3.D: Energy in Chemical Processes and Everyday Life	• Energy and Matter • Systems and System Models • Cause and Effect

Ecosystems & The Food Web Lesson Flow on Next Page

Ecosystems & The Food Web Lesson Flow

Anchor Phenomenon

Ecosystem Design & Modeling
Life Inside a Dome

Lesson 1

Food Chains, Producers, & Consumers
Why would a hawk move to New York City?

Anchor Connection

Lesson 2

Matter & Plant Growth
What do plants eat?

Anchor Connection

Lesson 3

Decomposers & Matter Cycle
Where do fallen leaves go?

Anchor Connection

Lesson 4

Decomposers, Nutrients, & Matter Cycle
Do worms really eat dirt?

Anchor Connection

Lesson 5

Ecosystems & Matter Cycle Why do you have to clean a fish tank but not a pond?

Anchor Connection

Lesson 6

Protecting Environments
How can we protect Earth's environments?

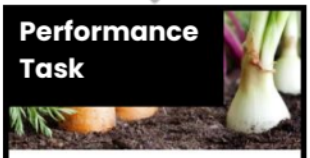
Anchor Connection

Lesson 7

Food Webs & Flow of Energy
Why did the dinosaurs go extinct?

Anchor Connection

Performance Task



Ecosystem Argument
How could we grow food on Mars?

Anchor Phenomenon Background

How can you create an ecosystem that will provide all the food your team needs?

This anchor layer introduces Biosphere 2, an experiment where scientists tried to create a self-sustaining ecosystem in a dome in the Arizona desert.

Your students will be a part of the Biosphere 2 team. Their job is to make sure that the dome's ecosystem can supply them with the food they need to survive.

To decide what's in their ecosystem, students will think about what they want to eat — and where that food comes from. If they want a fried egg for breakfast, they need a bird (probably a chicken) to lay that egg. For each food-producing organism, students will need to consider what that organism needs to thrive. Animals need food to eat. Plants need pollinators to reproduce.

Students will revisit their model ecosystem after each lesson, revising it as they learn more about the web of life.

Additional resources:

If your students want more information about the original Biosphere 2 project and what happened to it, consider showing them this video (https://video.link/w/6fQp).

If students need help figuring out a menu, here is a sample menu and answer key (https://mysteryscience.com/docs/808). Students can use this menu — or start with this and modify as they wish.

Some students struggle because they don't know what goes into the foods they eat. To help with that, here are recipes for our sample menu and a worksheet (https://mysteryscience.com/docs/809).

Anchor Phenomenon: Life Inside a Dome
Ecosystem Design & Modeling

Anchor Phenomenon
13 mins

Guided Inquiry
30 mins

Hands-On Activity
60 mins

Wrap-Up
2 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 focuses on attempts to grow food in an enclosed ecosystem. Students generate observations and questions about the phenomenon and create an initial design solution to growing food inside a dome for two years.

Student Work Samples & Notes

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 have an opportunity to change or add to their first model.

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?
Biosphere 2 is located in the desert, which is sunny during the day. Biosphere 2 has glass panels which will let in sunlight that plants need to grow. The trees inside Biosphere 2 will provide oxygen for animals. Biosphere 2 is not shaded, it will get a lot of sunlight.	Biosphere 2 is closed off from the outside world, nothing can come in or out. Biosphere 2 is a lot smaller than the Earth and everything you need has to fit inside. If all of the plants died, all of the animals would die and there would be no food. You have to cook everything; boxed items would run out.	What types of animals can live inside Biosphere 2? How many people need to be fed? What do the animals eat? What happens to all of the animal waste? How do living things depend on one another to survive? How does energy and matter move through an ecosystem?

Lesson 1: Why would a hawk move to New York City?
Food Chains, Producers, & Consumers

Exploration
15 mins

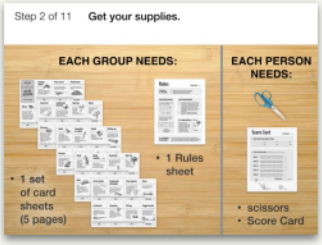
Hands-On Activity
30 mins

Anchor Connection
20 mins

Assessment
25 mins

Overview
In this lesson, students develop their thinking about the predator/prey relationships between living things.

In the activity, Eat or Be Eaten, students play a card game in which they make food chains with predators and prey, and producers and consumers. The students who make the longest food chains win the game!



Activity Notes
We suggest students work in groups of four. The "Eat or Be Eaten" game is designed for 2 to 4 players. Each group of players will need enough table space to lay out their cards as they form food chains.

Anchor Connection
Living things get their food through food chains. All 20 organisms students choose for their "My Biosphere" model must have a food source.

Students revisit the explanation and/or drawings that they worked on during the Anchor Phenomenon. They should understand that all living things need a food source in order to grow, and are all part of a food chain.

Students can update their explanations and/or drawings by:

- Changing which living things are included in their biosphere
- Drawing arrows to indicate food chains in their biosphere
- Ensuring that all food chains include producers

Connecting Storyline Question
Does every living thing in my ecosystem have something to eat?

Lesson 2: What do plants eat? (pg 1 of 2)
Matter & Plant Growth

Exploration
21 mins

Hands-On Activity
30 mins

Wrap-Up
4 mins

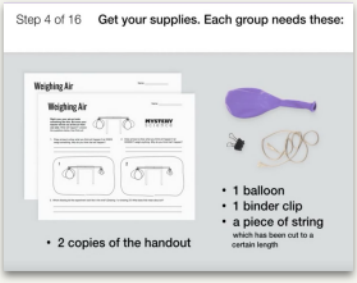
Anchor Connection
20 mins

Assessment
25 mins

Overview

In this lesson, students discover the surprising nutrient which accounts for most of a plant's food.

In the activity, Weighing Air, students blow up balloons and place them on both sides of a large balance scale constructed from a yardstick. Then, students let the air out of all the balloons on one side of the balance to directly observe that air has weight.



Activity Notes

You will need to prepare the string and make a balance scale before class. This will take about 20 minutes. You need a cleared off desk or table to set up your balance scale. You also need a yardstick, 5 medium binder clips, 2 jumbo paper clips, a wooden ruler, a pencil, and a heavy book. Follow the directions on the lesson page to make your balance scale.

We suggest students work in pairs for the first part of the activity. You will need a minimum of eight balloons for this activity to work. The supplies calculated on the lesson page will provide one balloon per pair of students. If that gives you more than 8 balloons, that's fine. You can run the experiment multiple times.

See our lesson page for more detailed prep instructions, suggestions to make the activity run smoothly, and a way to find your ideal string length based on your balloon diameter.

Anchor Connection on Next Page

Lesson 2: What do plants eat? (pg 2 of 2)
Matter & Plant Growth

Exploration
21 mins

Hands-On Activity
30 mins

Wrap-Up
4 mins

Anchor Connection
20 mins

Assessment
25 mins

Anchor Connection

Most of the matter that makes up plants comes from the air. Food can be traced back to plants. Plants are necessary for a healthy ecosystem. Students need to include plants in their "My Biosphere" model.

Students revisit the explanation and/or drawings that they worked on during the Anchor Phenomenon. They should understand that all living things in a food chain can trace their energy source backwards to plants.

Students can update their explanations and/or drawings by:

- Showing how plants get the nutrients that they require

Connecting Storyline Question

What would happen to my ecosystem if the plants don't have what they need?

Lesson 3: Where do fallen leaves go? (pg 1 of 2)
Decomposers & Matter Cycle

Exploration
20 mins

Hands-On Activity
30 mins

Anchor Connection
20 mins

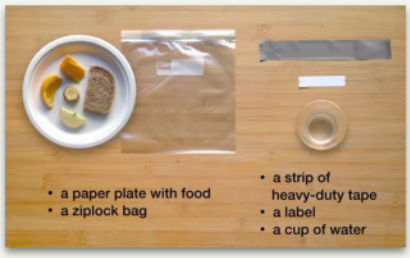
Assessment
25 mins

Overview

In this lesson, students discover the role fungi play in decomposing dead materials and in creating soil.

In the activity, Mold Terrarium, students plan and conduct an investigation to discover the factors affecting decomposition. Students fill Ziploc bags with different types of foods and change environmental conditions to study how different variables affect mold growth. They then observe mold growth over a period of two weeks.

You may want to divide this activity into two sessions. Part 1 (students brainstorm ideas for their mold terrarium) takes 10 to 15 minutes. Part 2 (students set up their mold terrariums) takes 15 to 20 minutes. Part 2 begins at Step 7.



Activity Notes

You will need access to water for this activity. In addition to the supplies listed on the lesson page, you will need a well-ventilated area to store your mold terrariums. The space you have available may limit how many terrariums you make.

Each mold terrarium will be sealed in a Ziploc bag that is then sealed with duct tape. Students will observe mold through the clear plastic, but will not open the bags. When your observation period is over, you will throw the entire experiment away. Do not open the bag. Opening the bag would release mold spores, which can exacerbate asthma and cause respiratory illness.

We suggest students work in groups of four. See our lesson page for more detailed prep instructions.

Anchor Connection on Next Page

Lesson 3: Where do fallen leaves go? (pg 2 of 2)
Decomposers & Matter Cycle

Exploration
20 mins

Hands-On Activity
30 mins

Anchor Connection
20 mins

Assessment
25 mins

Anchor Connection

Decomposers break down dead or decaying organisms. Decomposers are necessary for a healthy ecosystem. Students need to include decomposers in their "My Biosphere" model.

Students revisit the explanation and/or drawings that they worked on during the Anchor Phenomenon. They should understand that decomposers play an important role in the ecosystem and can always be found in a healthy ecosystem.

Students can update their explanations and/or drawings by:

- Adding decomposers to their biosphere

Connecting Storyline Question

How could we get rid of dead plants and animals inside the Biosphere?

Lesson 4: Do worms really eat dirt? (pg 1 of 2)
Decomposers, Nutrients, & Matter Cycle

Exploration
16 mins

Hands-On Activity
45 mins

Wrap-Up
4 mins

Anchor Connection
20 mins

Assessment
25 mins

Overview

In this lesson, students discover the critical role earthworms play in decomposing dead material and releasing nutrients into the soil.

During a two-part activity, Ask a Worm, students observe earthworms and then design their own "fair test" investigations of earthworm behavior. Students first make close observations of worms. Then, students conduct a simple experiment with multiple trials to figure out if worms prefer dry or wet areas. They consider what a "fair test" is and design an experiment to answer other questions about worms.

Part 1:

Part 2:

Activity Notes

Source your worms in advance. We suggest students work in groups of four. Students will share supplies with their group in Part 1 and share experiment ideas with their group in Part 2. You will need access to water for this activity. See our lesson page for more detailed prep instructions.

Red worms (also known as red wigglers) can be purchased from a garden store or ordered by mail from a variety of online sources. We recommend ordering from Uncle Jim's Worm Farm. At bait shops, you can sometimes find red worms, but more commonly you'll find earthworms. The bigger red worms are great for observations and in the natural habitat, they burrow deep in the soil, making red worms a better choice if you want to make a worm bin. Red worms live in the top layers of the soil, feeding on decomposing leaves and organic debris

Anchor Connection on Next Page

Lesson 4: Do worms really eat dirt? (pg 2 of 2)
Decomposers, Nutrients, & Matter Cycle

Exploration
16 mins

Hands-On Activity
45 mins

Wrap-Up
4 mins

Anchor Connection
20 mins

Assessment
25 mins

Anchor Connection

Decomposers recycle nutrients back into an ecosystem. Students add arrows into their food chains to show the movement of nutrients from decomposers to soil.

Students revisit the explanation and/or drawings that they worked on during the Anchor Phenomenon. They should understand that worms help an ecosystem by recycling nutrients back into the soil.

Students can update their explanations and/or drawings by:

- Showing how decomposers recycle nutrients within the biosphere

Connecting Storyline Question

How would adding worms to the Biosphere affect the ecosystem?

Lesson 5: Why do you have to clean a fish tank but not a pond?

Ecosystems & Matter Cycle (pg 1 of 2)

Exploration
22 mins

Hands-On Activity
45 mins

Wrap-Up
3 mins

Anchor Connection
20 mins

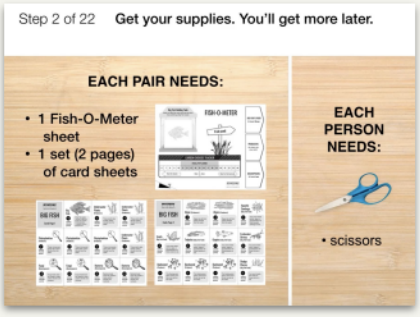
Assessment
25 mins

Overview

In this lesson, students combine what they have learned about plants, animals, and decomposers to see how they interact in an ecosystem.

In the activity, Pond Ecosystem Game, students first build a pond ecosystem that will support a sunfish. To succeed, they must make sure that carbon dioxide levels are healthy for both plants and animals. Then, students play a game called Big Fish where they compete to make a healthy ecosystem for a sunfish.

Part 1 (building an ecosystem) takes 10 to 15 minutes. Part 2 (playing the game) takes at least 20 minutes. You may want to divide this lesson into two sessions, stopping after Part 1 and continuing with the game at a later point. If you plan to do the activity in two sessions, the group game begins at Step 12.



Activity Notes

In Part 1 of this activity, students will work in pairs. In Part 2 of this activity, students will work in groups of four to play the Big Fish game.

See the lesson page for tips on dividing materials and prepping if you are planning to divide the activity into two sessions.

Anchor Connection on Next Page

Lesson 5: Why do you have to clean a fish tank but not a pond?

Ecosystems & Matter Cycle (pg 2 of 2)

Exploration
22 mins

Hands-On Activity
45 mins

Wrap-Up
3 mins

Anchor Connection
20 mins

Assessment
25 mins

Anchor Connection

Organisms in an ecosystem depend on one another to cycle energy and nutrients. Students add arrows into their "My Biosphere" model to show the movement of nutrients between organisms.

Students revisit the explanation and/or drawings that they worked on during the Anchor Phenomenon. They should understand that ecosystems can become toxic if there is too much carbon dioxide and not enough plants or decomposers to recycle it.

Students can update their explanations and/or drawings by:

- Showing how living things add or remove carbon dioxide to and from the air in the biosphere

Connecting Storyline Question

What happens if one living thing becomes overgrown in an ecosystem?

Lesson 6: How can we protect Earth's environments?
Protecting Environments (pg 1 of 2)

Exploration
20 mins

Hands-On Activity
35 mins

Wrap-Up
7 mins

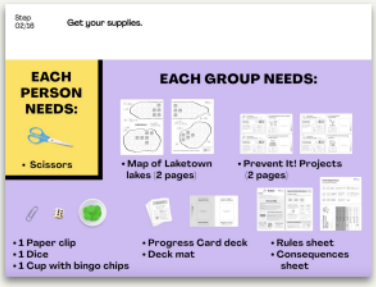
Anchor Connection
20 mins

Assessment
25 mins

Overview

In this lesson, students discover what happens in unbalanced ecosystems and how that can lead to an overabundance of algae and harmful algal blooms.

In the activity, Bloom Busters, students play a game in which they obtain and combine science ideas in order to help a community respond to and prevent harmful algal blooms.



Activity Notes

Teacher Background: This lesson focuses on green algal blooms, but algae come in a variety of colors. So depending on where you live, you may be more familiar with different types of harmful algae blooms, such as "red tide".

We suggest students play the game in groups of three.

For detailed prep instructions on how to prepare cups with bingo chips, decks of cards, and organizing group materials, see the lesson page.

Anchor Connection on Next Page

Lesson 6: How can we protect Earth's environments?
Protecting Environments (pg 2 of 2)

Exploration
20 mins

Hands-On Activity
35 mins

Wrap-Up
7 mins

Anchor Connection
20 mins

Assessment
25 mins

Anchor Connection

All organisms in an ecosystem require water to survive. Students add information to their "My Biosphere" model to explain how they would protect their water supply from a harmful algae bloom.

Students revisit the explanation and/or drawings that they worked on during the Anchor Phenomenon. They should understand that all living things require water. Maintaining a clean water supply in a biosphere is very important.

Students can update their explanations and/or drawings by:

- Explaining how to keep the water in their biosphere safe from a harmful algae bloom

Connecting Storyline Question

Which is more similar to a Biosphere: a pond or a fish tank? Why?

Lesson 7: Why did the dinosaurs go extinct? (pg 1 of 2)
Food Webs & Flow of Energy

Exploration
15 mins

Hands-On Activity
30 mins

Wrap-Up
5 mins

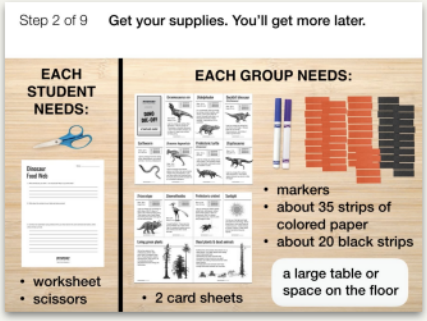
Anchor Connection
20 mins

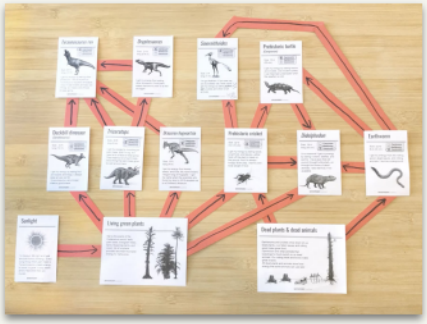
Assessment
25 mins

Overview

In this lesson, students investigate the hypothesis that an asteroid impact caused the extinction of the dinosaurs.

In the activity, Create a Dinosaur Food Web, students use cards and construction paper connectors to create a food web from the time of the dinosaurs. Using this model, they follow the flow of energy through the food web and figure out why dinosaurs went extinct but some other animals survived.





Activity Notes

We suggest students work in pairs.

Each pair of students needs an area that's about 2 feet by 3 feet for their completed food web. Plan for enough space. Students can work at desks, tables, or on the floor.

If you have access to a paper cutter, we suggest you use one to prepare the construction paper strips.

Cut the black construction paper into strips measuring 3" by ¾". Cut your colored construction paper into strips measuring about 4" by ¾".

Anchor Connection on Next Page

Lesson 7: Why did the dinosaurs go extinct? (pg 2 of 2)
Food Webs & Flow of Energy

Exploration
15 mins

Hands-On Activity
30 mins

Wrap-Up
5 mins

Anchor Connection
20 mins

Assessment
25 mins

Anchor Connection

All energy in an ecosystem first came from the sun. Students add a source of energy to their "My Biosphere" model and arrows to show the movement of energy.

Students revisit the explanation and/or drawings that they worked on during the Anchor Phenomenon. They should understand that energy from the sun is the original energy source for entire ecosystems.

Students can update their explanations and/or drawings by:

- Showing how energy flows within their biosphere

Connecting Storyline Question

What could cause the Biosphere ecosystem to collapse?

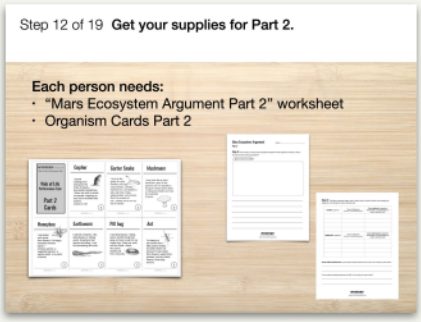
Performance Task: How could we grow food on Mars?
Ecosystem Argument

Unit Review
30 mins

Hands-On Activity
60 mins

Overview

In this performance task, students evaluate a proposed ecosystem plan for a Mars habitat. Using evidence from the unit, they will write an argument for or against the proposed ecosystem plan. Then, students will make recommendations about how to change the ecosystem to successfully cycle energy and nutrients, keeping humans alive and healthy.



Performance Task Notes

Students will need their completed Biosphere Bites packet that they have been revising after each Mystery.

In Part 1, students evaluate a list of proposed organisms for a Mars habitat. They write an argument for or against the proposal as a good ecosystem.

In Part 2, students make recommendations on how to improve the ecosystem.

Crosscutting Concepts

Systems and System Models: All living things in an ecosystem are dependent on one another to get the energy and nutrients they need to survive.

Energy & Matter: Energy and matter can be transferred between living organisms. All living things need energy and nutrients to survive. Living things transfer energy and nutrients to one another in an ecosystem.