Science Learning Packet

Grade 7:
Matter & Energy in Ecosystems,
Lesson 1

Science learning activities for SPS students during the COVID-19 school closure.

Seattle Public Schools is committed to making its online information accessible and usable to all people, regardless of ability or technology. Meeting web accessibility guidelines and standards is an ongoing process that we are consistently working to improve.

While Seattle Public Schools endeavors to only post documents optimized for accessibility, due to the nature and complexity of some documents, an accessible version of the document may not be available. In these limited circumstances, the District will provide equally effective alternate access.

Due to the COVID-19 closure, teachers were asked to provide packets of home activities. This is not intended to take the place of regular classroom instruction but will help supplement student learning and provide opportunities for student learning while they are absent from school. Assignments are not required or graded. Because of the unprecedented nature of this health crisis and the District’s swift closure, some home activities may not be accessible.

If you have difficulty accessing the material or have any questions, please contact your student’s teacher.
Matter and Energy in Ecosystems:
Lesson 1.2
Hello Families,

We hope you and your family are well and safe during this time. During this unprecedented out-of-school time, the SPS middle school science team will be offering instructional opportunities for students that align with the district’s adopted middle school science instructional materials.

This investigation packet is the first part in a series of district-aligned lessons about Matter and Energy in Ecosystems, a 7th grade life science unit developed by AmplifyScience. While Amplify Science lessons are designed to be done in the classroom with peers, there are some activities that students can complete at home. In this packet you will find activities to accompany lessons 1 and 2 of the unit. Accompanying lesson videos will be aired on SPS TV and posted the SPS webpage under Grade 7, however this packet can be used with or without the accompanying video.

The videos can be accessed either online or through Seattle’s Public television programming on SPS TV (local channel 26), social media (Facebook and Instagram: @SeattlePublicSchools, Twitter: @SeaPubSchools), and our SPSTV YouTube channel. KOMONews.com will also host on-demand videos under the tab “Lesson Plan” and broadcast on channel KOMO 4.3. These supplemental learning videos feature short segments supporting a variety of subjects and grade levels. All videos will be close captioned on YouTube. For more information regarding the SPS TV broadcast schedule and to find the videos, please visit the following website: https://www.seattleschools.org/departments/media_operations_center___sps-tv/broadcast_schedule

For students who have access to the internet and the following devices and browsers may wish to log-in to their AmplifyScience account from home are welcome to do so. See below for guidance on which browser

- **Desktops and Laptops** (Windows 7+, Mac OS 10.11+) - *Suggested browsers: Chrome & Safari*
- **Chromebooks** - *Suggested browser: Chrome*
- **iPads that support iOS11.3+** (iPad5+) - *Suggested browser: Safari*

Sincerely,

Seattle Public Schools Science Department
Just last year NASA announced that the first human mission to Mars will be sometime in the 2030s! That’s in OUR lifetime!

Since then, there are so many different scientists in the world that have been trying and preparing to figure out how humans can survive on Mars.

One of the biggest challenges that scientists face is in trying to figure out how to create an Earth-alike atmosphere on a different planet. Today we are going to focus on one type of experiment that scientists have been working on to try and figure out this question.

**VIDEO: The Biodome Project.** If you have access to the internet or are viewing on TV, view the video now to learn about the Biosphere project.

What is one thing you found interesting about this biosphere?

What questions do you have about living in a biosphere?
Introducing the Biodome

Five years ago, a local group called the Econauts began an ambitious project to determine if humans could survive on another planet. They constructed a biodome, an ecosystem inside a glass dome larger than a football field. The ecosystem was filled with plants, animals, and a volunteer group of eight humans.

The Problem

For the first few years, the plants and animals inside the biodome seemed healthy and normal. In the last few years, however, the Econauts began to notice some problems. Animals were getting sick and failing to reproduce.

Plants weren’t growing as big or producing as much fruit as they once did. The Econauts realized that something had gone wrong. Although the organisms were safely removed from the biodome, the cause of these problems is still a mystery.
Why didn’t the plants and animals in the biodome have enough energy storage molecules?

Welcome to the Biodome Investigation Team! You just learned about Biosphere 2, an experimental research facility that was built for learning more about Earth and its ecosystems.

Five years ago, the Econauts constructed a biodome similar to Biosphere 2. They recently noticed that the organisms inside the biodome were getting sick and failing to reproduce. To protect the people and organisms inside, they shut down the biodome. The Econauts hired us to figure out what caused their biodome to fail, but we need your help. I’m including a presentation that explains your mission in more detail.

Student ecologists, we are counting on you!

Bryan
Dr. Bryan Corry, Head Ecologist
Biodome Investigation Team

**Vocabulary**

*energy storage molecule:* a molecule that organisms can use to release the energy they need to survive
What is the connection between energy storage molecules and plants that do not grow and animals that do not reproduce?
Examining the Biodome Files

We will begin to investigate the Chapter Question by examining some documents from the biodome that Dr. Corry left us. As you read, look for information that might help you figure out why there weren’t enough energy storage molecules for plants and animals in the biodome. Remember, these are just your initial claims, so don’t worry about being right or wrong. As you read through the files, you will be brainstorming as many possibilities as you can as to why there not enough energy storage molecules. The more hypotheses we can generate, the faster we can figure out what happened to the Biodome!

Reading: “Biodome File 1: News Stories”

Group Builds Ecosystem from Scratch

The Econauts, a local group of space fans, have built a glass dome bigger than a football field. Inside, they have installed their very own ecosystem, complete with trees, plants, and animals. The dome is completely enclosed, but the plants and animals inside should have all the air and water they need to survive. This type of enclosed ecosystem is known as a biodome.

Members of the group plan to live sealed inside this biodome for several years. Their aim is to find out whether humans could build domes like this on the Moon, Mars, or other planets, creating livable spaces and food sources out in space.

The members of Econauts are not astronauts or scientists, just space fans who hope to live in space someday. Group members have varied backgrounds, including careers in business, advertising, gardening, medicine, and goat farming.

Other organizations have attempted to build biodomes in the past, with little long-term success. Ecosystems are complicated, and it’s not so easy to create one that can survive in a sealed glass dome. In order to design their biodome, the Econauts group has hired expert...
ecologists to give their advice on what kinds of plants and animals to include, and how many of each. With the advice of these ecologists, the group members hope their constructed ecosystem will be self-sustaining, with plenty of plants for the animals to eat, plenty of sunlight and water for the plants, and plenty of air for both.

The human occupants will also be eating food farmed and raised in the biodome. Econaut Sarah Willard stated, “I’m really excited to live inside this biodome and help take care of the animals and plants. It will feel like being one of the first humans to live in a colony on another planet.”

**Biodome Fails: Ecologists to Determine Why**

Five years ago, a local group of space fans called the Econauts constructed an ecosystem sealed under glass—a biodome. Recently, the group noticed an ominous decrease in the populations of organisms: the ecosystem appeared to be in the process of collapsing. The occupants were safely removed from the biodome, but the cause of the crash is still a mystery. A group of expert ecologists has been hired to investigate the failed biodome and try to determine what went wrong. They will advise the Econaut group on how a second attempt could be improved.
Each of the eight Econauts has been assigned a specific job based on his or her work and interests outside the biodome. They are expected to perform the requirements listed in the descriptions of their jobs, as well as record their activities at least once per season.

The Econauts

Harrison Grant is a 26-year-old water technician from Phoenix, Arizona, who has taken responsibility for the Econauts’ water system. He has loved space since he was a little boy and has thought a great deal about possible water systems for use in space, though he isn’t a professional space scientist.

Biographies

Harrison Grant is a 26-year-old water technician from Phoenix, Arizona, who has taken responsibility for the Econauts’ water system. He has loved space since he was a little boy and has thought a great deal about possible water systems for use in space, though he isn’t a professional space scientist.
Erica Li is a 22-year-old college student from Kihei, Hawaii. She is working toward a career in advertising. Erica grew up hunting wild pigs with her family and getting oysters and crabs from the ocean. She learned about the biodome while taking astronomy classes in college, and she can’t wait to bring her hunting and foraging skills into the dome.

Sarah Willard is a 29-year-old goat farmer from Wenatchee, Washington, and she’ll be caring for the Econauts’ herd of twenty goats. Sarah has been an amateur astronomer since she was a teenager, and she never expected that her goat-farming skills would help people learn how to live in space. She’s looking forward to keeping the biodome goats happy and healthy.

Jeff Anderson is a 28-year-old gardener from Fort Collins, Colorado, who is responsible for growing all of the Econauts’ food. Jeff became interested in space on an eighth-grade trip to the Kennedy Space Center in Florida, and has dreamed since then of contributing to the future of humans in space. He hopes his work in the biodome will help future generations learn to grow food if they settle on other planets.

Ana Lopez is a 52-year-old doctor from Greenville, South Carolina, who will provide medical care in the biodome. Ana is fascinated by the idea of living in space, and has studied the medical needs of people living in enclosed spaces so she is prepared to take great care of the Econauts during their project.

Keith Yoo is a 24-year-old banker from Pittsburgh, Pennsylvania, who will serve as the Econauts’ groundskeeper. Keith has no experience with maintaining an ecosystem, but he’s interested in the psychology of people living in confined spaces, so he’s excited to offer his services to the team.

Gabriel Gutierrez is the Econauts’ chef. He is 35 years old and comes from Oklahoma City, where he specializes in farm-to-table cooking. Gabriel works with a local university to study ways of introducing more natural food into the diets of people in space, and he is excited about the challenge of cooking good food from limited sources.

Celeste Parker is a 38-year-old computer network administrator from Minneapolis, Minnesota. She has dreamed of living in space since she was a girl, and hopes to buy a ticket for one of the first commercial flights in space. She will run all of the technology required for the Econauts’ biodome.

**Econaut Job Assignments**

**Gardener:** Jeff Anderson
Pick fruits and vegetables and deliver them to the chef. Make sure all plants are receiving enough water. Plant new fruits and vegetables as necessary.

**Groundskeeper:** Keith Yoo
Maintain biodome buildings and grounds. Rake up dead leaves, place them in sealed garbage bags, and bury them at least 6 feet underground.

**Computer Systems Operator:** Celeste Parker
Make sure all computer equipment is working properly, and enter all biodome data for graphing.
**Water Maintenance:** Harrison Grant Check and maintain the water system so there is enough water available to all organisms.

**Chef:** Gabriel Gutierrez Prepare breakfast, lunch, and dinner for each of the residents. Make sure food provides what the Econauts’ bodies need.

**Hunter:** Erica Li Hunt rabbits with bow and arrow and deliver to chef. Search for fruits and edible plants in the forest area.

**Goatherd:** Sarah Willard Care for goats, making sure they have plenty to eat and drink. Milk goats and deliver milk to chef.

**Doctor:** Ana Lopez Provide basic medical care and regular checkups to all biodome residents.

**Burial Duty:** All (this job rotates monthly) In order to keep the biodome looking orderly and full of life, we will bury any animals or plants that die. They will be placed in sealed garbage bags and buried at least 6 feet underground. We will bury all garbage as well.
## Reading: “Biodome File 3: List of Recommended Organisms to Include in the Biodome”

### Active Reading Strategies
- Use red pencil (or other color: ) to underline evidence
- Use green pencil (or other color: ) to circle unit glossary words and unfamiliar words
- Write definitions above circled words
- Write in the margins to identify questions, impactful ideas, and “A-ha!” moments

<table>
<thead>
<tr>
<th>Producers</th>
<th>Primary Consumers</th>
<th>Secondary Consumers</th>
<th>Decomposers</th>
</tr>
</thead>
<tbody>
<tr>
<td>bananas</td>
<td>pygmy goats</td>
<td>boars</td>
<td>worms</td>
</tr>
<tr>
<td>papayas</td>
<td>billy goats</td>
<td>tilapia (fish)</td>
<td>soil bacteria</td>
</tr>
<tr>
<td>sweet potatoes</td>
<td>chickens</td>
<td>spiders</td>
<td>soil fungus</td>
</tr>
<tr>
<td>beets</td>
<td>cockroaches</td>
<td>snakes</td>
<td>pill-bugs</td>
</tr>
<tr>
<td>peanuts</td>
<td>ants</td>
<td>oysters</td>
<td>beetles</td>
</tr>
<tr>
<td>cowpea beans</td>
<td>bees</td>
<td>crabs</td>
<td></td>
</tr>
<tr>
<td>rice</td>
<td>hummingbirds</td>
<td>reptiles</td>
<td></td>
</tr>
<tr>
<td>wheat</td>
<td>bats</td>
<td>scorpions</td>
<td></td>
</tr>
<tr>
<td>morning glories</td>
<td>moths</td>
<td></td>
<td></td>
</tr>
<tr>
<td>phytoplankton (tiny algae)</td>
<td>zooplankton (tiny aquatic animals)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>rubber trees</td>
<td>butterflies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mosses</td>
<td>termites</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ferns</td>
<td>turtles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>elodea (aquatic plant)</td>
<td>brine shrimp</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>rabbits</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

I wonder why they decided not to include worms. Bacteria need worms to break dead matter into smaller pieces so bacteria can feed on it.

It’s a good thing that they included producers for both land and water ecosystems.
Think about your initial claims to the Chapter question - are they about the **biotic** or **abiotic** matter in the ecosystem?

**Vocabulary**

**ecosystem**: all the living and nonliving things interacting in a particular area

**system**: a set of interacting parts forming a complex whole

**biotic matter**: matter that makes up the living and dead organisms of an ecosystem set of interacting parts forming a complex whole

**abiotic matter**: matter that makes up the nonliving parts of an ecosystem, such as air, water, and rocks
**Investigation Question:** Where do the energy storage molecules in an ecosystem come from? Explore the Matter & Energy digital Sim (short for simulation). It is a model of an ecosystem, and it is similar to the models that professional ecologists use to study ecosystems.

Key features of the Sim include:

- **Different types of molecules and atoms:** The Sim includes energy storage molecules, carbon, carbon dioxide, water, and oxygen. Oxygen and water are only visible in cell view.

- **How energy storage molecules move:** These molecules flow between the different parts of the ecosystem, such as when organisms die or eat other organisms.
• **Control buttons**: The Sim includes buttons that allow students to kill organisms, bury dead matter, burn dead matter, trap carbon dioxide, and adjust the amount of sunlight.

• **Graphs**: By pressing the graph icon, students are able to see visual data about the ecosystem and plot nine different quantities.

• **View Cell**: By pressing VIEW CELL, students can zoom in to see what is happening at the cellular level in various parts of the ecosystem.

• **Information**: By pressing the information icon, students can see numerical data rather than a visual representation of the ecosystem.

• **The words biotic matter and abiotic matter**: Where do we see these labels in the Sim?

---

<table>
<thead>
<tr>
<th>Part of ecosystem</th>
<th>Contains energy storage molecules? (yes or no)</th>
<th>Energy storage molecules flowing in? (yes or no)</th>
<th>Energy storage molecules flowing out? (yes or no)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Producers</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Consumers</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Decomposers</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Dead matter</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Abiotic matter</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
Where do energy storage molecules first appear in the ecosystem?

What ideas do you have about where energy storage molecules in an ecosystem come from?
Reflecting on Lesson 1.2

Where do the energy storage molecules in an ecosystem come from?

Before next time, share the evidence you’ve gathered today and your ideas about the Investigation Question with a family member or friend!