Science Learning Packet

Grade 7:
Matter & Energy in Ecosystems,
Lesson 2

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

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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 1.3
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 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
What You Need for This Lesson:
- A pen or pencil
- Some lined or blank paper
Optional but encouraged:
- Access to Amplify online
- Printed “Sunlight and Life” Article Set
- A family member or friend

➢ In this unit we are trying to find out why the Biodome failed.
➢ In this chapter, we are working toward answering the question: Why didn’t the plants and animals in the biodome have enough energy storage molecules?

The Role of Plants
Think about different types of plants found in an ecosystem.

Could you have an ecosystem without plants? Yes or No

Explain why or why not. ________________________________

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In this lesson we will investigate: Where do energy storage molecules in an ecosystem come from?

Read the **Sunlight and Life Article Set**

As you read, look for information that might help you figure out the Investigation Question!

**Reading: “Sunlight and Life”**

**Chapter 1: Introduction**

The edge of a big lake is full of life. Fish dart through the bright green reeds, ducks dive for algae growing in the shallow mud, and insects buzz everywhere. However, if you go out to the middle of the lake and dive to the bottom, you’ll find a dead zone—a dark and barren area hardly any organisms: no fish, no plants, not much of anything.

Why do some areas support so much life, while others are relatively lifeless? To survive, organisms need energy—and this energy comes from energy storage molecules. These molecules store energy that can be released in an organism’s body. Energy storage molecules include glucose, starch, and fat. Ecosystems with organisms need to have lots of energy storage molecules to keep those organisms alive. Some ecosystems contain lots of energy storage molecules, while others don’t contain as many.
Only producers (such as plants) can make the energy storage molecules that fuel life in an ecosystem. Energy storage molecules are made mostly of carbon, and carbon is all around us in the form of carbon dioxide gas.

Producers take in carbon dioxide molecules from the air and water. Using energy from sunlight, producers combine the carbon dioxide molecules with water molecules, changing them into glucose molecules and oxygen molecules. This process is called photosynthesis. Through photosynthesis, producers take carbon from abiotic matter and move it into biotic matter in the form of glucose. Then the organisms in an ecosystem can use that glucose to make other energy storage molecules, like starch and fat.

The process of photosynthesis takes place in tiny cell parts called chloroplasts. Only producers have them, so only producers can do photosynthesis. In order to get the energy to do photosynthesis, producers need sunlight.

Sunlight is one reason some ecosystems have so many more energy storage molecules—and so much more life—than others. With more sunlight, producers like plants and algae can do more photosynthesis. They take more carbon out of the atmosphere and turn it into more energy storage molecules to meet their energy needs. As producers make more energy storage molecules, consumers—the animals that eat the producers—get more energy storage molecules from eating the producers. Those consumers use energy from the energy storage molecules to survive and reproduce, increasing in number. Then secondary consumers—the ones that eat animals—are able to get more energy storage molecules from eating the primary consumers that ate the plants. An ecosystem that gets lots of sunlight can support lots of organisms, while an ecosystem that gets less sunlight can support fewer organisms.

To find out about other ecosystems where the amount of sunlight has a big effect on the amount of living things, read one of the chapters that follow.

**Photosynthesis**

Using energy from sunlight, carbon dioxide and water react to form glucose (an energy storage molecule) and oxygen. During this reaction, atoms are rearranged.
Chapter 2: Arctic Seasons

The Arctic is the area near Earth’s North Pole. If you visit the Arctic in winter, you’ll see a dark, wind-swept landscape, with no plants visible and a few hardy animals searching for food in the snow. If you visit the same spot in summer, it’s completely transformed. Low plants bloom everywhere. Big herds of grazing animals feast on the plants, and wolves lurk around the edges of the herds, hoping to feast themselves. The air is alive with insects and birds.

What causes this transformation? Because of the way Earth tilts in its orbit around the sun, the North Pole points toward the sun in summer and away from the sun in winter. This means that the North Pole is in darkness 24 hours a day during the winter: for months, the sun is never seen. However, during the summer, the North Pole is in sunlight 24 hours a day: for months, the sun never sets.

All that sunlight fuels a boom in photosynthesis. Plants and other producers take in water from melted snow and carbon dioxide from the air. Using energy from sunlight, they transform the water and carbon dioxide into oxygen and glucose, a type of energy storage molecule. This transformation happens through the process of photosynthesis. Because the sun never sets in the summer, Arctic plants can photosynthesize 24 hours a day, constantly producing energy storage molecules that are stored in their bodies, available for animals to eat.
The plant-eating animals that live in the Arctic time their reproduction so their offspring are born at just the right time to take advantage of this bounty of plants (and energy storage molecules). As the animals digest the plants, they use the carbon in glucose to make other energy storage molecules, like fat, which can be stored for times when there is less food. Arctic predators also time their reproduction to the season, having offspring just when lots of food is available for them in the form of other young animals. Reproduction leads to a population boom for the year-round residents of the Arctic. However, that’s not the only reason there are more animals in the Arctic in summer: birds and many other animals migrate to the Arctic in summer to feast and reproduce. When summer ends, they go away again to sunnier areas.

As summer ends and the sunlight dies away, the plants stop photosynthesizing and lie dormant. Many plants survive the winter as seeds. Only a few animals remain. Some hide themselves away and hibernate through the long winter—not eating at all and using as little energy as possible. Darkness descends, and the Arctic once more becomes a relatively lifeless winter landscape.

**Chapter 3: Coral Reefs and Clear Water**

Coral reefs form in clear, shallow water with lots of sunlight. Reefs may look like they are made of rock, but they’re not—reefs are living structures made up of millions of tiny animals called coral polyps. Their hard skeletons stick together to form reefs that may be up to 2,300 kilometers (1,429 miles) long! What’s even more amazing about coral reefs is the huge number of different organisms that make their homes in them: fish, sea stars, urchins, shrimp, sponges, crabs, sharks, and more.

Coral reefs depend on sunlight. Why? Coral polyps are animals, not plants—they can’t do photosynthesis. However, inside each tiny polyp are even tinier algae made of just one cell each. These algae are producers, and it’s their ability to do photosynthesis that gives life to the reef ecosystem.

As sunlight filters through the clear, shallow water, the algae perform photosynthesis. There is carbon dioxide dissolved in ocean water, and the algae take in carbon dioxide along with water. Using energy from sunlight, the algae change the water and carbon dioxide molecules into oxygen molecules and glucose, a type of energy storage molecule. The energy storage molecules are stored in the bodies of the algae. Because the algae live inside the coral polyps, the polyps are able to use some of the energy storage molecules produced by the algae for their own energy needs.

With a constant supply of energy storage molecules, the coral polyps grow and reproduce, forming huge reefs. Many types of fish eat coral...
clear water that the sunlight can penetrate. If the water above a coral reef becomes too muddy or polluted, the whole reef ecosystem is threatened. Muddy water blocks sunlight, preventing it from reaching the coral reef. Without sunlight, the algae inside the coral polyps can’t photosynthesize. The algae run out of energy storage molecules, and they quickly die. Without access to the energy storage molecules from the algae, the coral polyps soon die as well. The fish and other animals that depended on the coral die off or swim away to find other food. A coral reef without access to sunlight becomes a skeletal reef—it can’t support the life it did before. Sunlight truly is life to a coral reef.

In this close-up photo of coral polyps, you can see the tiny green algae living inside them!

Coral reefs thrive in places where sunlight can shine through shallow, clear water.

Muddy water blocked the sunlight and killed this coral reef. Most of the animals that lived there died off.

Parrotfish eat coral polyps. If you dive near a reef, you can hear parrotfish munching on the coral.
Chapter 4: Light Shafts on the Rain Forest Floor

We usually think of rain forests as being full of life, and the treetops definitely are. The leafy branches of tall rain forest trees are known as the canopy, and this is where most organisms in the rain forest are found. Colorful birds fly back and forth, eating fruit or insects, mating, and nesting. Rain forest plants take root up in the treetops, growing on high tree branches. Each branch of a rain forest tree is like a garden, with dozens of different kinds of plants growing on it and insects and other small organisms everywhere.

The vibrant life of the rain forest canopy is powered by sunlight. Rain forest trees and the smaller plants growing on their branches use the energy from sunlight to perform photosynthesis: they take in carbon dioxide from the atmosphere and water from all the rain that falls. Through the process of photosynthesis, the trees and plants change the carbon dioxide and water into oxygen and a type of energy storage molecule called glucose. These energy storage molecules are stored in the bodies of the trees and plants and become available for insects, birds, and other animals to eat. Because so many energy storage molecules are available, huge numbers of organisms can meet their energy needs in the rain forest canopy.

The rain forest floor, on the other hand, is dark and shady—a very different place from the canopy. Leaves block most of the sunlight on its way down. In fact, only about 2% of the sunlight that hits the rain forest penetrates down all the way to the ground. Because there is so little sunlight on the rain forest floor, plants at that level can’t photosynthesize very well. There are
relatively few plants growing on the rain forest floor, which means that there is not a lot of photosynthesis going on and few energy storage molecules available for animals to eat. The lack of sunlight means that the rain forest floor cannot support as much life as the rain forest canopy.

However, when a huge tree falls, all that changes. A falling tree rips a big hole in the rain forest canopy, letting a shaft of sunlight hit the forest floor. As sunlight warms the ground, seeds that may have been lying there for years begin to sprout. In the shaft of sunlight, plants and young trees start growing. With access to sunlight, these plants can photosynthesize, changing carbon dioxide and water into oxygen and energy storage molecules. The plants store the energy storage molecules in their bodies, where they become available for animals to eat. The shaft of sunlight brings life to the rain forest floor, at least for a while. Eventually, the young trees will grow tall and block the sunlight once more.
Think back to the lesson Investigation Questions - *Where do energy storage molecules in an ecosystem come from?* - then, go back and look at what key ideas you circled, underlined, or highlighted in the reading above.

1. What evidence did you gather from the readings that relate to the investigation question?

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2. Share your ideas about where the energy storage molecules in an ecosystem come from!

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To prepare for Lesson 3, please read the article below!

**Reading: “What is Carbon?”**

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!”

All these things contain carbon.

What’s in diamonds, steel, plastic, plants, and animals—including you? It’s carbon! Carbon is a type of atom, and it’s all around you.

Carbon is essential to life on Earth. All biotic matter—the matter that makes up living things—has carbon in it. Along with nitrogen and oxygen, carbon is one of the most important atoms that
make up biotic matter. There are carbon atoms in energy storage molecules like glucose, starch, and fats, as well as in proteins, DNA, and most of the other types of molecules that living things need to survive. Whenever you eat, part of what you’re eating is made up of carbon. Carbon helps make up the bodies of animals, plants, bacteria, and all other living things. Carbon is even found in the dead remains of living things, which are another type of biotic matter.

Carbon isn’t only found in biotic matter, though. If you’ve ever used a pencil, you’ve seen and touched pure carbon—it’s the black stuff that makes up the tip that you use to write. People often call this part of a pencil the “lead,” but it is actually a substance called graphite, which is made up entirely of carbon atoms. Although the tip of a pencil may break when you use it, pure carbon can also form one of the hardest substances found on Earth: diamond. In addition to graphite and diamonds, carbon is found in many other kinds of abiotic matter, like steel and plastic.

You can see carbon in the form of a pencil or a diamond, but in other forms, carbon is actually invisible. The air all around you contains an invisible gas called carbon dioxide, which—you guessed it—is partly made up of carbon. You add carbon dioxide gas to the air with every breath you take. Whenever you breathe out, you give off carbon in the form of carbon dioxide. This carbon dioxide becomes part of the abiotic matter of Earth’s atmosphere.

Why is carbon found in so many different kinds of matter, both biotic and abiotic? It’s because carbon atoms are good at joining with each other and with other types of atoms to form molecules. That ability to join with other atoms allows carbon to make up many different types of things, from diamonds to
invisible gases to living things like you.