

**FIFTH GRADE CURRICULUM
TABLE OF CONTENTS:**

Unit 1: Plants & Energy Flow
What would our world look like without plants?

Fifth Grade Unit 1: Plants & Energy Flow

OVERVIEW:

In this unit, students will be able to demonstrate an understanding of how energy is received and transferred between plants, animals and humans. They will begin by reviewing plant structures and functions and how these structures help plants survive (Lesson 1). Then they will observe a variety of plants and learn the essential components of photosynthesis (Lesson 2). In the third lesson, they will piece this information together by finding evidence of food chains in the garden and learning how energy flows in an ecosystem (Lesson 3). In the final lesson, students brainstorm, design, and build their own solar oven, learning that they, like plants, can harness energy from the sun (Lesson 4).

Lesson #	Guiding Question	Student Outcomes
1.	What structures and functions keeps plants alive?	Students determine the functions of different parts of the plant.
2.	What do plants eat?	Students demonstrate their understanding of photosynthesis by making a prediction.
3.	How does pond scum turn into a wolf?	Students understand that energy is never created or destroyed, and rather is transferred between living things.
4.	How could humans get energy from our garden?	Students test the solar ovens they designed using thermometers and timers.

Materials to Acquire in Advance:

- Lesson 4: solar oven making materials

Images and some background content in the Grade 4 curriculum come from unknown sources. These lessons were created and adapted by Education Outside for use in garden classrooms.

NGSS Connections:

Disciplinary Core Ideas:

- LS1.A: Structure and Function: Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.
- LS1.C: Organization for Matter and Energy Flow in Organisms: Plants acquire their material for growth chiefly from air and water. (5-LS1-1)
- PS3.D: Energy in Chemical Processes and Everyday Life
- 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: Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion. (secondary to 5-PS3-1)
- ETS1.B: Designing Solutions to Engineering Problems: Testing a solution involves investigating how well it performs under a range of likely conditions.(secondary to 4-ESS3-2)
- ESS3.A: Natural Resources: Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. (4-ESS3-1)

For Reference:

Scientific & Engineering Practices:

<https://www.nap.edu/read/13165/chapter/7>

Cross-Cutting Concepts:

<https://www.nap.edu/read/13165/chapter/8>

TITLE | WHAT STRUCTURES AND FUNCTIONS KEEP PLANTS ALIVE?

GRADE | Fifth Grade

UNIT | 1

LESSON | 1

Time: 45 - 60 minutes

Unit Essential Question: What would our world look like without plants?

Focus Question: What structures and functions keep plants alive?

Objectives: Understand the structures and functions of a plant

Summary: Students attempt to answer the question, “What structures and functions are keeping plants alive?” through the below table.

Engage	Students collect plants and learn the term dissect.
Explore	Students dissect plants and brainstorm functions of each plant part.
Explain	Students share out the parts of a plant and their functions, and one student is dressed up as a plant.
Elaborate	Students create an argument for what the most essential plant part is.
Evaluate	Students describe the functions of different parts of the plant.

Materials:

- Plant part costume (The costume shown in the paper is made entirely of paper. Alternatively, you can use the following: roots: brown or tan string, stem: green gown or paper cutouts, leaves: fake leaves from a craft store, flower: flower headband or clip, fruit: apple or orange, seeds: bag of seeds)
- Plants/weeds from the garden, one per student
- Worksheets (attached below)
- Crayons or colored pencils
- Plant function description strips (attached below)
- Parts of a Plant poster, available in the Curriculum Visuals linked in the Table of Contents
- Tape



Tips for Preparing the Lesson:

- Pull weeds/plants from the garden ahead of time, or provide time for students to pull them in the “Engage” section of the lesson.
- Plant part costume can be assembled from various materials or made from paper.
- Cut out plant function descriptions and place tape on the back so they can be added to plant part poster.

Prior Knowledge: Students should be familiar with parts of a plant.

Grade 4, Lesson 1: Lesson Steps

Engage: Students collect plants and learn the term dissect.

Time: 5 mins

Materials:

- Plants collected for dissection (optional)
- Worksheets

Teacher

1. **Ask** *What are some of the structures that keep us (humans) alive? [students respond] Students will ideally say heart, stomach, lungs, etc.*
2. **Say:** *Yes, we as humans have different body parts that keep us alive. Ask Do plants have structures that keep them alive? [students respond]*
3. **Say:** *We are going to be dissecting and looking on the inside to figure out how plants work. Our main goal is to figure out what structures and functions are keeping this plant alive.*
4. Teaching Preparation - Option 1: Pick entire plants/weeds from the garden for student dissection and set in a tray to distribute. Option 2: Have students pick weeds from the garden make sure they are picking the entire plant from the ground.
5. Inform students that today we will be doing a dissection. Give a brief definition of dissection, instructing students that dissect means to take apart. Use hand motions to solidify the definition.
6. **Say** *We have three jobs today. First, we have to dissect the plant in front of us. Second we need to separate the plant into its different parts, and finally, we need to brainstorm what the function or job each part of the plant is.*
7. Students should tape the different parts of the plant onto the worksheet and write the function. They can write the name of the plant part or come up with their own name to describe it.

Explore: Students dissect plants and brainstorm functions of each plant part.

Time: 20 mins

Materials:

- Plants
- Pencils
- Worksheets
- Clipboards
- Tape

Teacher

1. **Distribute** plants, worksheets, and pencils to pairs of students.
2. **Give** students time to dissect each plant and brainstorm the function of the various parts.
3. After 20 minutes bring students back to the circle for the next activity.

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Explain: Students share out the parts of the plants and their functions, and one student is dressed up as a plant.

Time: 15 mins

Materials:

- Plant part costume

1. **Have** students set aside their dissected plants.
2. Explain to students that as a class they are responsible for explaining each part of the plant. **Say** *I want to learn from you about each part of the plant. We will start from the base of the plant and move towards the top.*
3. **Say:** *I need one brave volunteer to help me visualize the parts of the plant by dressing up. (If students do not want to do this, ask the classroom teacher to volunteer)*
4. Have different pairs of students choose a section of the plant to share about. As groups are sharing about a part of the plant **dress** up the student or classroom teacher with that part of the plant part costume. Verbally add in information about function of the plant parts as necessary.
5. NOTE: **Comment** on the bravery of student for dressing up in a costume in front of the class. Be mindful of the student wearing the costume be sure to ask for consent before putting on different pieces of the costume.
6. As you name each part of the plant use your body to act out related motion. For example: Roots: touch toes (slurp sound), Stem: move hands from lower shin to knee (representing water moving through stem), Leaves: Use hands to wiggle fingers and face towards the sun, Flower: hold up hand “petals” on head, Fruit: Fold hands criss-cross, Seed: hold one clenched hand out.

Elaborate: Students create an argument for what the most essential plant part is.

Time: 5 mins

Materials:

- *Parts of a Plant* poster
- Plant function descriptions

1. **Review** the 6 plant parts with students. **Say** each part of the plant and have students show you the corresponding motion. Continue to **practice** all 6 until students are familiar with each part.
2. Place the plant part function descriptions into a hat. Have students pick a plant function description, read it aloud and then tape it onto the poster next to the correct plant part.
3. Ask students if there are any parts of the plant that were not mentioned.
4. **Give** students time to choose what structure of the plant is the most essential. **Have** students brainstorm why they believe that is the most essential part of the plant.
5. **Have** students turn to their partner and share out the most essential plant part and explain their reasoning.

Evaluate: Students describe the functions of different parts of the plant.

Time: 5 mins

Materials:

- Plant Parts from dissection

1. **Hold** up 2 - 3 parts of a plant and have students turn to a partner to describe the function of that part.
2. Review plant part names and motions.

Lesson Extensions

- Have students watercolor or draw all the parts of a plant.

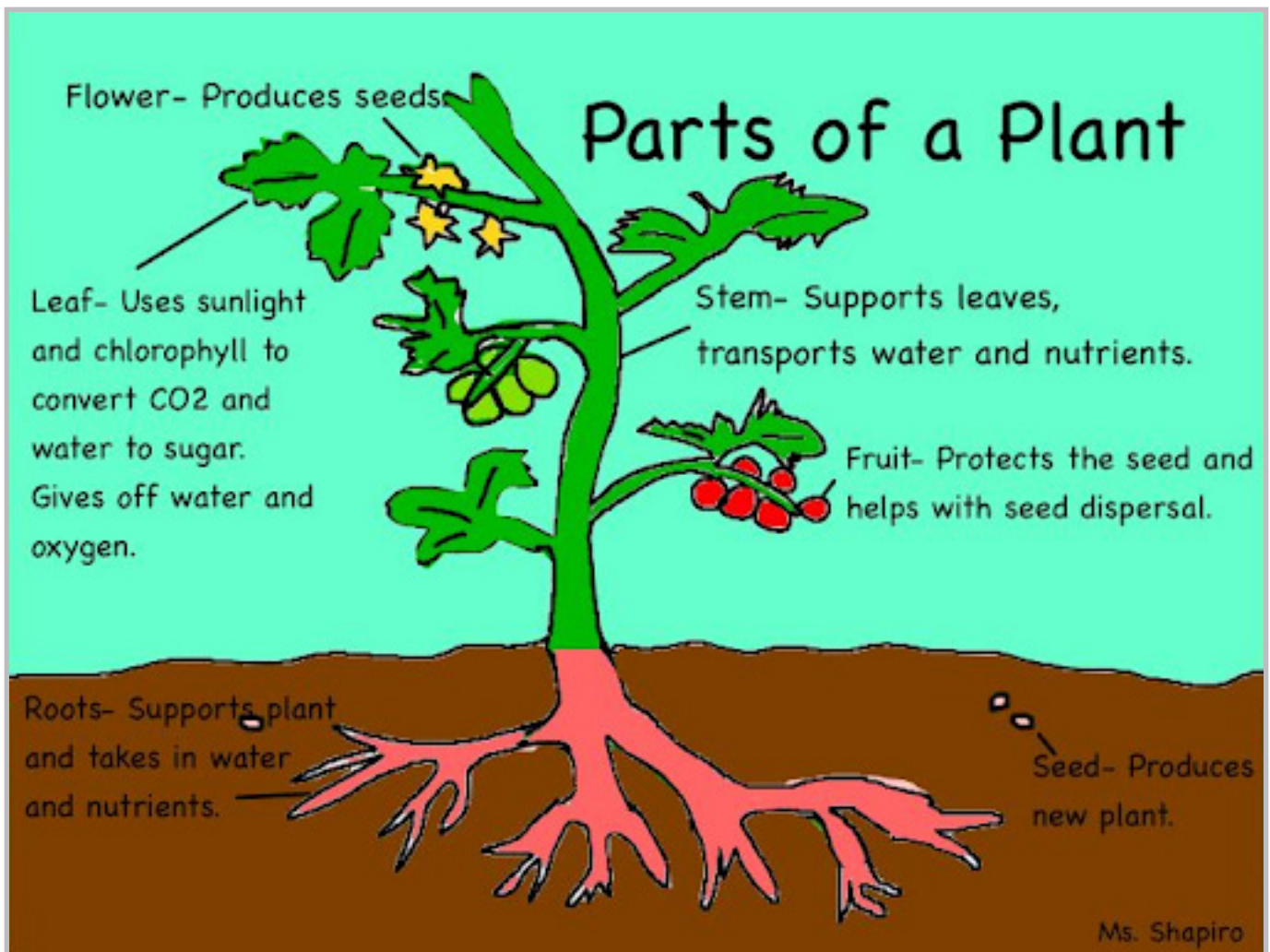
Grade 5, Lesson 1: Lesson Background

Key Terms:

Dissect: the action of taking apart a body or plant to study its internal parts.

Content Knowledge:

The “Parts of a Plant” image below is from Ms. Shapiro’s Technology Blog.¹



NGSS Connections:

- LS1.C: Organization for Matter and Energy Flow in Organisms: Plants acquire their material for growth chiefly from air and water. (5-LS1-1)
- LS1.A: Structure and Function: Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (4-LS1-1)

References:

1. Shapiro. (2009, October 5). Parts of a Plant [Web log post]. Retrieved June 20, 2019, from <https://heightstechnology.edublogs.org/2009/10/05/parts-of-a-plant/>

Name _____

Date _____

What keeps me alive?

Plant Structure (Plant Part)	Plant Function (What it does)

Roots: Support plant and take in water and nutrients.

Stem: Supports leaves, transports water and nutrients.

Leaves: Use sunlight and chlorophyll to convert CO₂ and water to sugar. Give off water and oxygen.

OR

Use sunlight, water and minerals to make food for the plant.

Flower: Produces seeds.

Fruit: Protects the seed and helps with seed dispersal.

Seed: Produces a new plant.

TITLE | WHAT DO PLANTS EAT?

GRADE | Fifth Grade

UNIT | 1

LESSON | 2

Time: 45 - 60 minutes

Unit Essential Question: What would our world look like without plants?

Focus Question: What do plants eat?

Objectives: Students will be able to explain that plants use sunlight, water, and air to create their own food.

Summary: Students attempt to answer the question, “what do plants eat?” through the below table.

Engage	Students discuss plant needs in order to solve a mystery.
Explore	Students observe healthy and unhealthy plants to determine what plants eat.
Explain	Students act out the process of photosynthesis through a play.
Elaborate	Students discuss the mystery of the dead plant and determine the cause of death.
Evaluate	Students demonstrate their understanding of photosynthesis by making a prediction.

Materials:

- (optional) Caution tape
- Dead weed or other plant
- Clipboards
- Pencils
- Worksheets (attached below)
- Station materials
 - Air plant (or a picture of one)
 - A plant (prepared in advance) with aluminum foil wrapped around 1 or 2 leaves
 - A marked garden bed with healthy plants (Can use a flag, cone, or other item to mark the bed)
 - A plant in water with no soil
- Necklaces for students to wear that say PLANT, SUNLIGHT, WATER, OXYGEN, CARBON DIOXIDE, SUGAR
- Photosynthesis poster, available in the *Curriculum Visuals* linked in the Table of Contents

Tips for Preparing the Lesson:

- If using caution tape, wrap it around an area with a dead plant.
- Prepare station materials.
- The plant with foil wrapped leaves should be prepared 4-7 days in advance (the covered leaves should look dead/brown)
- The other 3 stations should have healthy plants
- Review the correct responses for the worksheet (See **Background Section**)

Prior Knowledge: Students should be familiar with parts of a plant and their functions

Grade 5, Lesson 2: Lesson Steps

Engage: Engage students and elicit prior knowledge by discussing plant needs in order to solve a mystery

Time: 10 mins

Materials:

- Caution tape (*optional*)
- Dead weed or other plant

Teacher

1. **Show** students an area of the garden with caution tape around a dead plant.
2. **Say:** *I need your help! A great tragedy has happened in the garden. When I arrived this morning I found that this kale plant [or any plant you have] had died of starvation over the weekend! I need YOUR help to figure out why this plant wasn't getting food.*
3. **Ask:** Who feeds plants? [students respond]
That's right! Plants make their own food! To solve our mystery, we first need to figure out, what plants eat! To get us started, let's think about what plants need to survive. Turn to a partner and brainstorm all of the things that plants need to survive.
Partners share, then **discuss** as a whole class.
4. **As students respond, write** *SUN, SOIL, WATER, AIR on the board in a row.*
5. **Say:** *Now let's think back to the six plant parts we learned about last week. Which part makes food? Show me the motion for the plant part that makes food.*

Engage: Students explore the phenomenon by observing healthy and unhealthy plants in order to determine what plants eat

Time: 20 mins

Materials:

- Clipboards
- Pencils
- Worksheets (attached below)
- Station materials
- Air plant (or a picture of one)
- A plant (prepared in advance) with aluminum foil wrapped around 1 or 2 leaves
- A marked garden bed with healthy plants (Use a flag, cone, or other item to mark the bed)
- A plant in water with no soil

Teacher

1. **Say:** *I have one BIG clue for you all...not all of the things that plants need (sun, soil, water and air) help them to make food. There are clues set up around the garden for us to examine. We will look at some healthy/fed plants, and some starving plants to figure out which things are necessary for plants to make food.* (Garden educator should emphasize that these stations contain clues, and students are expected to have an educated guess but they might not know the answer.)
2. **Show** the worksheet. **Explain** that students will determine if the plant is fed or hungry, and then write which of the four needs the plant is getting or not getting. (The plant could be missing more than one need.)
3. **Send** students to each station. **Rotate** through stations (about 4 minutes per station)
 - **Station 1:** Air plant
 - **Station 2:** Plant with foil-covered leaves (take the foil off of one leaf so students can see)
 - **Station 3:** Garden bed with healthy plants
 - **Station 4:** Plant in cup of water
4. **Discuss** as a class or in partners what students think plants eat. Take a class **vote** to identify which of the four needs plants use to make food. **Tally** responses.
5. By the end of the activity students should be able to tell that plants don't need soil to make food, but do need sun, water and air.

Explain: Students act out the process of photosynthesis through a play. (This activity is adapted from "Plant Food Magic" in *The Growing Classroom*.¹)

Time: 10 mins

Materials:

- Necklaces for students to wear that say PLANT, SUNLIGHT, WATER, OXYGEN, CARBON DIOXIDE, SUGAR
- *Photosynthesis* poster

Teacher

1. **Say** *We will be acting out a story that is our final clue to understanding what plants eat.* **Encourage** students to think about how this new information fits with what they've observed so far.
2. **Ask** the classroom teacher to choose students to be a part of the play:
 - (PLANT)
 - (SUNLIGHT)
 - (CARBON DIOXIDE)
 - (WATER)
 - (SUGAR)
 - (OXYGEN)
3. **Distribute** necklaces to the selected students.
4. **Read** a story about a plant creating food, having students act out the story as you read:
 - *"Once upon a time, there was a PLANT growing in a beautiful garden. The PLANT was so happy because it was a lovely, warm day with plenty of SUNLIGHT to shine down upon its leaves. The PLANT was happy to feel that the soil was wet--it sucked up some WATER with its roots. The PLANT brought the WATER up its stem to its leaves. It opened the holes in its leaves to breathe in some CARBON DIOXIDE. The leaves are the kitchens of the plant. In the leaves, WATER, CARBON DIOXIDE, and SUNLIGHT mixed to make SUGAR. It used the SUGAR to grow bigger, and released some OXYGEN into the air."*
5. **Review the story of photosynthesis** using the Photosynthesis poster. Tell students that photosynthesis is a special word to describe the process plants use to make food.

Elaborate: Students discuss the mystery of the dead plant and determine the cause of death

Time: 5 mins

Materials:

- Worksheets from previous activity

Teacher

1. **Instruct** students to write what plants use to make food on their worksheets.
2. **Pair-Share:** Students should discuss in partners or groups which of the four plant needs the dead plant was missing, and how they know.

Evaluate: Students demonstrate their understanding of photosynthesis by making a prediction.

Time: 5-10 mins

Materials:

1. **Pair-Share:** What do you predict would happen if we tried to grow a plant in a dark closet? [Ask students to explain their rationale and how this would affect photosynthesis.]
2. **Ask** “Why do people/animals eat plants?” **Discuss** how plants produce energy, and when we eat plants, we get their energy. Explain that plants are also called “producers.”

Lesson Extensions:

Plants create oxygen demonstration: Place leaves in a clear plastic cup or other container filled with water. After one hour, have students observe the under-side of the leaves. They should be able to see small oxygen bubbles. Doing this activity at the beginning of the lesson can help hook students and get them to start asking questions and engaging with the inquiry process.

Card Sort: Students sort cards into input/output equation

- Write each component of photosynthesis on colored paper (Sunlight, →, Oxygen, Water, Sugar, and Carbon Dioxide). Make several sets, each on a different color. Distribute individual cards to students. Ask them to find the other students in their group with the same color card, and arrange their cards in the correct order. *Optional: make additional cards that have chemical names (Sunlight, →, O₂, CO₂, H₂O, C₆H₁₂O₆)*

Grade 5, Lesson 2: Lesson Background

Key Terms:

Photosynthesis: the process through which plants use water, sunlight, and carbon dioxide to create their food (sugar) and release oxygen into the air.

Producer: organisms that produce their own energy

Roots: Support plants and takes in water and nutrients.

Stems: Support leaves, transport water and nutrients.

Leaves: Use sunlight and chlorophyll to convert CO₂ and water to sugar. Give off water and oxygen.

Flowers: Produce seeds.

Fruit: Protect seeds and help with seed dispersal.

Optional - Stomata: holes in the underside of leaves that “breathe in” carbon dioxide

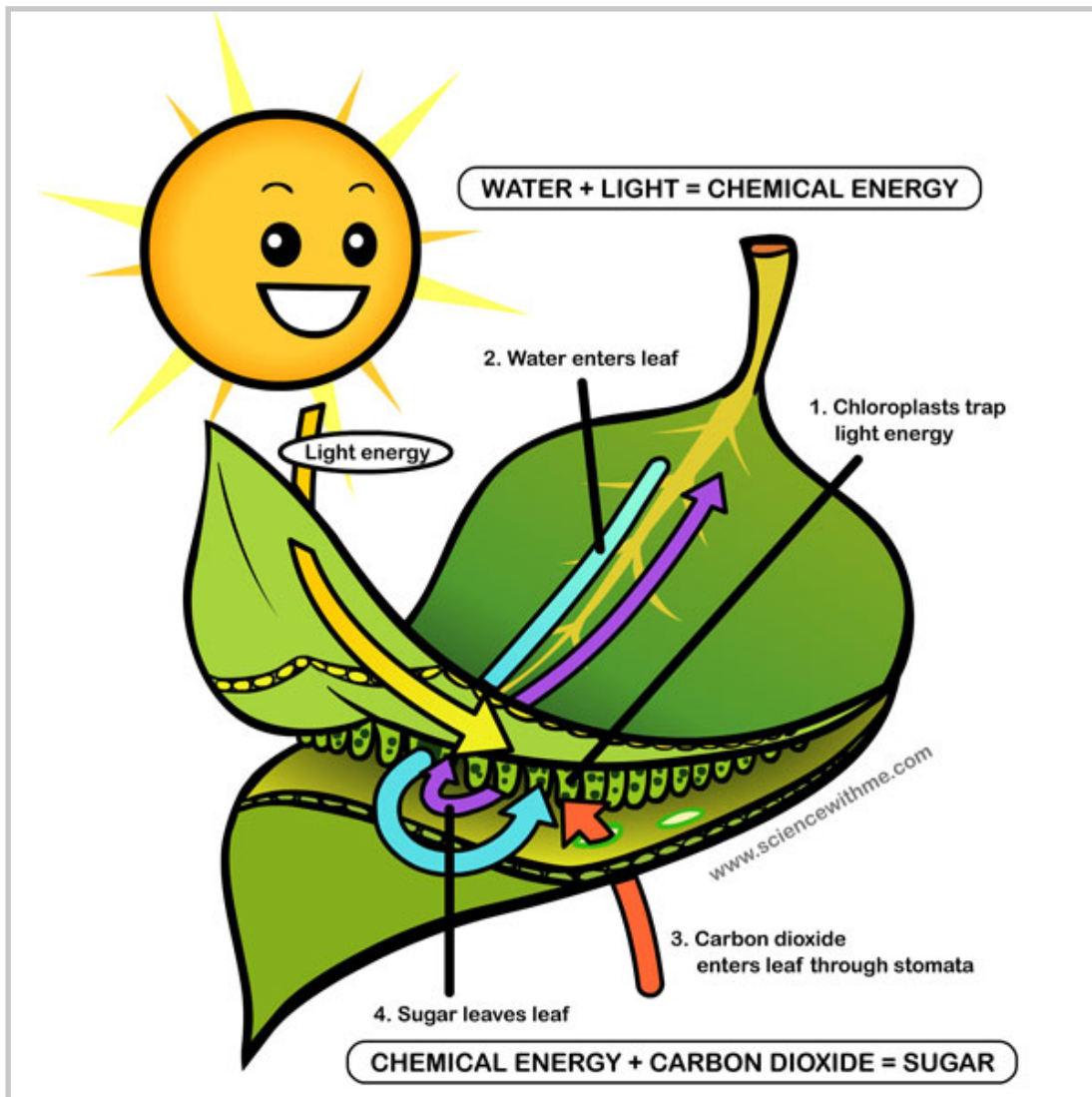
Optional - Chloroplasts: tiny food producers inside of leaves that contain chlorophyll

Optional - Chlorophyll: green colored matter found in chloroplasts in plant leaves that absorb sunlight

Worksheet responses:

Air Plant (Healthy/Fed)	Garden Bed (Healthy/Fed)	Covered Leaves (Unhealthy/Starving)	Plant in Water (Healthy)
Has: air, sun	Has: soil, water, sun, air	Has: soil, water, air	Has: water, air, sun
Missing: soil, water (does get water, but students won't be able to observe this)	Missing: none	Missing: sun	Missing: soil

The photosynthesis visual below is from the “Science With Me” blog.²



Teaching Tips:

- Using a picture of an air plant instead of a real air plant is a good option if air plants are unavailable.
- Free-flow through the stations might reduce the time required but will also require strong classroom management.

Common Misconceptions:

- **Plants don't need soil to eat:** Soil is the only plant need that is not directly involved in photosynthesis. Soil provides nutrients for other processes, like preventing disease and providing strong support structures.
- **Air plants take in water:** It might be hard for students to see that air plants take in water. Whereas other plants take in water through their roots, air plants absorb moisture through their leaves. Each leaf on an air plant is covered in specialized scales known as trichomes, which have the ability to absorb water and nutrients. Some trichomes are smooth, others are hairy.³
- **Most plants stop making food at night:** Some plants stop making food at night, but others (like desert plants) have enough energy stored from long exposure to the sun to continue photosynthesizing in the dark.
- **Only green plants photosynthesize:** Plants that are other colors besides green also make their own food. These plants still have chlorophyll, which is green, but also have other pigments that can mask the green color. These plants might appear red, orange, yellow, etc.

NGSS Connections:

Disciplinary Core Ideas:

- *LS1.C: Organization for Matter and Energy Flow in Organisms: Plants acquire their material for growth chiefly from air and water. (5-LS1-1)*
 - Students will understand that plants use energy from light to make sugars (food) from carbon dioxide and water through the process of photosynthesis, which also releases oxygen by studying plants that have sufficient needs and those that don't.
- *PS3.D: Energy in Chemical Processes and Everyday Life*

Students will understand that plants need solar energy to produce sugars (food) and release oxygen in that process by studying plants and acting out a story about photosynthesis.

References:

1. Jaffe, R., Appel, G. (2016). *The Growing Classroom*. Burlington, Vermont: KidsGardening.
- Elva. (2015, April 23). Learn about photosynthesis. Retrieved June 21, 2019, from <http://sciencewithme.com/learn-about-photo-synthesis/>
- Forney, J. M. Air Plant Care. Retrieved June 24, 2019, from <https://www.hgtv.com/outdoors/flowers-and-plants/houseplants/air-plant-care>

Worksheet:

Name: _____

What do plants eat?

	Station 1	Station 2	Station 3	Station 4
Circle one	Fed? Hungry?	Fed? Hungry?	Fed? Hungry?	Fed? Hungry?
Write: What needs does it have? <ul style="list-style-type: none">● Sun● Soil● Water● Air				
Write: What needs is it missing? <ul style="list-style-type: none">● Sun● Soil● Water● Air				

What do plants eat? _____

What is the dead plant missing? (It could be missing more than one thing!) _____

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TITLE | HOW DOES POND SCUM TURN INTO A WOLF?

GRADE | Fifth Grade

UNIT | 1

LESSON | 3

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Time: 45 - 60 minutes

Unit Essential Question: What would our world look like without plants?

Focus Question: How does pond scum turn into a wolf?

Objectives: Students will be able to describe food chains in the garden, and will understand that energy is transferred between organisms in an ecosystem.

Summary: Students attempt to answer the question: “How does pond scum turn into a wolf?” through the below table.

Engage	Students discuss the mystery of how pond scum could turn into a wolf.
Explore	Students find organisms and evidence of food chains in the garden.
Explain	Students share their garden food chain observations and garden educator introduces vocabulary words related to their findings.
Elaborate	Students solidify their understanding of food chains and determine which organisms are producers, consumers, and decomposers.
Evaluate	Students understand that energy is never created or destroyed, and rather is transferred between living things.

Materials:

- Food chain, wolf, pond scum, and cut-out visuals (Below)
- Worksheets (Below)
- Clipboards
- Pencils
- Key terms cut outs (Below)
- Tape

Tips for Preparing the Lesson:

- If possible, laminate the pond scum visual and food chains visual. Also laminate the key terms cut-outs and visual cut-outs, and place double sided tape on the back. This will allow you to more easily reuse the visuals for multiple classes. If a laminator is not available sheet protectors can be used instead.
- Print extra worksheets in case students finish early and want to continue exploring.
- The lesson activity requires diversity of life in the garden area.

Prior Knowledge: Students should know that plants get their energy from the sun, and that they use the sun, water, and air to make their own food through photosynthesis.

Grade 5, Lesson 3: Lesson Steps

Engage: Students discuss the mystery of how pond scum could turn into a wolf.

Time: 3 mins

Materials:

- Food chain, wolf, and pond scum visuals
- Visual cut-outs with tape on the back

Teacher

1. **Present** the visuals of wolf and pond scum/algae.
2. **Ask** *How do you think pond scum turns into a wolf?* **Emphasize** that it does!
3. **Have** students turn and talk with a partner to discuss the question.
4. **Record** student answers on the board.
5. **Tape** the pond scum visual to the board.
6. **Tell** the story and have students act out different pieces.
 - **Say:** *Once upon a time in a land far far away, there was a small pond. This pond had lots of happily living organisms in it. But one that few people remembered to think about was algae. [Point to pond scum visual.] Everyone always thought of algae as just scum, pond scum. But this pond scum did something that many organisms can't do. It lived in water could and photosynthesize! It took all the energy from the sun that it could and made its own food. It ate well. But then small insects like flies would come along. [Tape the fly cut-out to the pond scum.] They would eat up as much pond scum as they could and use the energy they got from the algae to fly away happily. Until one day, when the fly was discovered by [insert student actor name here] the Frog. [Tape the frog cut-out on top of the fly.] This frog feasted on the fly and got enough energy from it to hop along. But then one day as the frog was heading back to the pond, [student name] the Hawk, swooped down and took [student name] the frog home for lunch. [Tape the hawk cut-out on top of the frog.] [Student name] the Hawk ate [student name] the frog and got its energy to spread its hawk wings and fly away. Until one day, [student name] the Wolf caught [student name] the Hawk taking a rest from frog hunting. [Tape the wolf cut-out on top of the hawk.] [Student name] the Wolf ate and got its energy from the [student name] the Hawk, and that is how pond scum turns into a wolf.*
7. **Introduce** the term "food chain" using the food chain visual as an example.
 - **Say:** *A food chain is a series of organisms that rely on the organism before it for food.*
 - **Say:** *Pond scum got its energy from the sun to make its food. We eat lots of different things to get our energy. Every living thing on this planet gets energy to survive by eating or making their own food. Everything that eats gets eaten.*
 - **Say:** *Today we are going to try to find food chains that exist right here in our garden by asking these questions:*
 - *Where does this organism get its energy? What does it eat?*
 - *Where does this organism's energy go? What is it eaten by?*

Explore: Students find organisms and evidence of food chains in the garden.

Time: 10-15 mins

Materials:

- Worksheets
- Clipboards
- Pencils

Teacher

1. **Explain** that students will try to find two or more food chains in the garden.
2. **Have** students start with one organism (i.e. a sunflower, bird, worm, fava bean plant, etc.)
3. **Have** students think about what this organism eats to get its energy and where its energy goes (what is it eaten by). **Encourage** students to look for evidence of creatures in the garden, even if they don't see the actual creatures.
4. **Release** students for the activity. **Allow** enough time for students to make observations (10 - 15 minutes).
5. **Provide** students with extra worksheets if they finish early.
6. **Invite** students back.

Explain: Students share their garden food chain observations and garden educator introduces vocabulary words related to their findings.

Time: 5-10 mins

Materials:

- Clipboards
- Worksheets
- Pencils
- Key terms cut-outs with tape on the back
- Food chain visual

1. **Have** students pair-share their food chains.
2. **Ask** for a student to share their observations with the class.
 - **Ask** *What organism did you start with?*
 - **Ask** *Where did it get its energy from? (What did it eat?)*
 - **Ask** *Where did its energy go (What does it get eaten by?)*
3. **Introduce** key terms. After introducing key terms ask students to reflect back on the story at the beginning of class and identify which organism each one represents.
 - Producer - an organism that gets its energy from the sun to make its own food.
 - Primary consumer - an organism that mostly eats and gets its energy from producers.
 - Secondary consumer - an organism that eats and gets its energy from other consumers.
 - Decomposer - an organism that eats and gets its energy from dead or decaying things.
4. **Ask** a student to tape a key term to the appropriate organism on the food chains visual.
 - Producer - algae
 - Primary consumer - fly
 - Secondary consumers - frog, hawk, and the wolf
 - Decomposer - worm (not in the story but in visual)

Elaborate: Students solidify their understanding of food chains and determine which organisms are producers, consumers, and decomposers.

Time: 5 mins

Materials:

- Clipboards
- Worksheets
- Pencils

1. **Instruct** students to indicate which organisms on their food chains are producers, primary consumers, secondary consumers, and decomposers.
2. **Give** students time to assign terms to their organisms on their own.
3. **Ask** for student volunteers to describe their food chain to the class.

Evaluate: Students understand that energy is never created or destroyed, and rather is transferred between living things.

Time: 2-5 mins

Materials:

- Worksheets
- Cycle of Energy visual

1. **Ask or Discuss**
 - *Can energy die? / Can energy be created?*
 - *Can energy be born? / Can energy be destroyed?*
2. Ask students to refer to their worksheets for their answer.
3. **Explain**, using Cycle of Energy visual, that all of the energy and nutrients on the planet get recycled.
4. **Emphasize** that energy can never be created or destroyed, as demonstrated by our garden food chains.

Lesson Extensions:

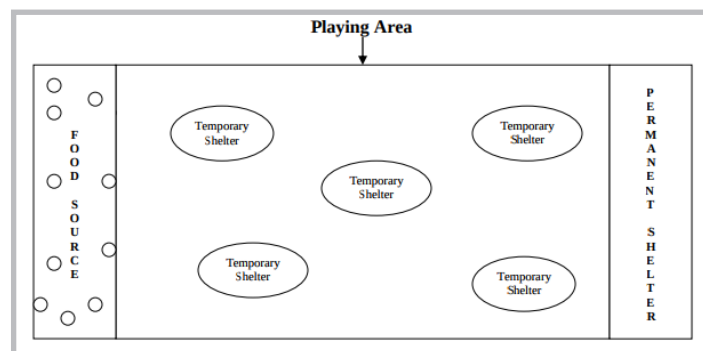
“Rock, Paper, Scissors, Eat!” Game:

- Play rock, paper, scissors where all students start out as the sun and attempt to make their way through the food chain to become a decomposer. (Each time a student wins, they move up one step in the food chain.)

- Sun → plant (producer) → primary consumer → secondary consumer → decomposer → sun
- Have students use the following motions to demonstrate their status during the game:
 - Sun: hold arms out in a large ball
 - Producer/plant: crouch down and hold hands above head to look like sprout
 - Primary consumer: crouch down and hold hands in front of the mouth in chomping motion
 - Secondary consumer: stand holding arms out in a large chomping motion
 - Decomposer: hold arms down toward body while moving in a wiggling motion

Predator-Prey Game: What eats gets eaten!

- Assign all but two students to be prey animals, and two students to be predators. The goal of the prey animals is to run from the permanent shelter area to the food source to gather at least three food items without being “eaten” (tagged) by a predator animal. The diagram below illustrates the game set-up.



Grade 5, Lesson 3: Lesson Background

Key Terms:

Food Chain: a series of organisms that rely on the organism before it for food.

Producer - an organism that gets its energy from the sun to make its own food.

Primary consumer - an organism that mostly eats and gets its energy from producers.

Secondary consumer - an organism that eats and gets its energy from other consumers.

Decomposer - an organism that eats and gets its energy from dead or decaying things.

Teaching Tips:

- For the benefit of explaining how energy is transferred from organism to organism, the garden educator can use additional visual cut-outs from the story and tape them on the board in a circle to indicate the cycle of energy.
- When telling the story, ask students to act out what is being told in the story.
- If students don't find the immediate prey or predator within their food chain, they can make an educated guess based on observations they've made outside of the garden.
- If students finish early encourage them to find another food chain or to think of one that might exist in other places (i.e. their neighborhood, Yosemite National Park, the rainforest, etc.). Provide additional worksheets.

NGSS Connections:

Disciplinary Core Ideas:

- PS3.D: Energy in Chemical Processes and Everyday Life

Students understand that energy from food was once energy from the sun

- LS1.C: Organization for Matter and Energy Flow in Organisms

Students understand that food provides organisms with the energy they need to live and survive

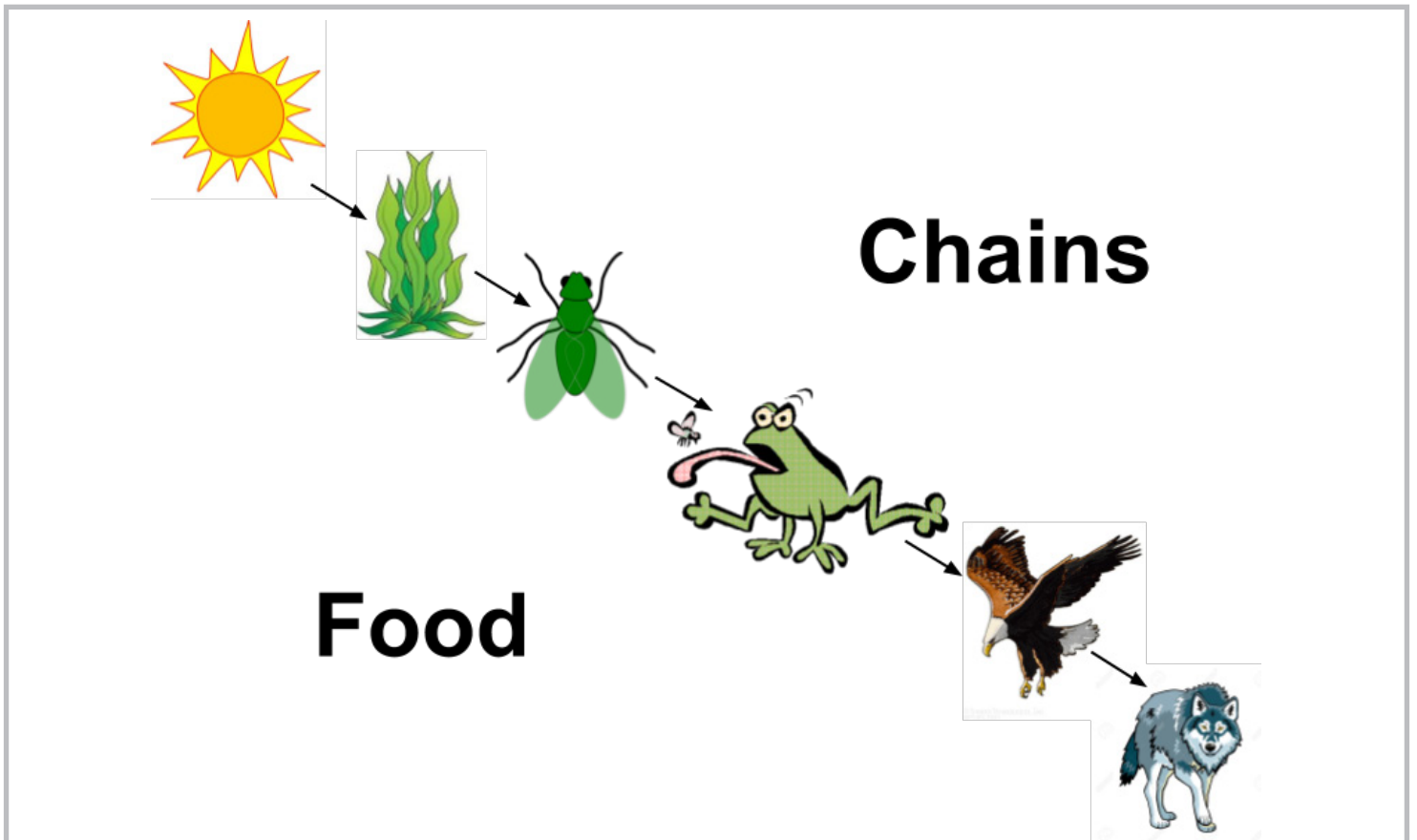
- LS2.A: Interdependent Relationships in Ecosystems

Students understand that food of almost any kind can be traced back to plants

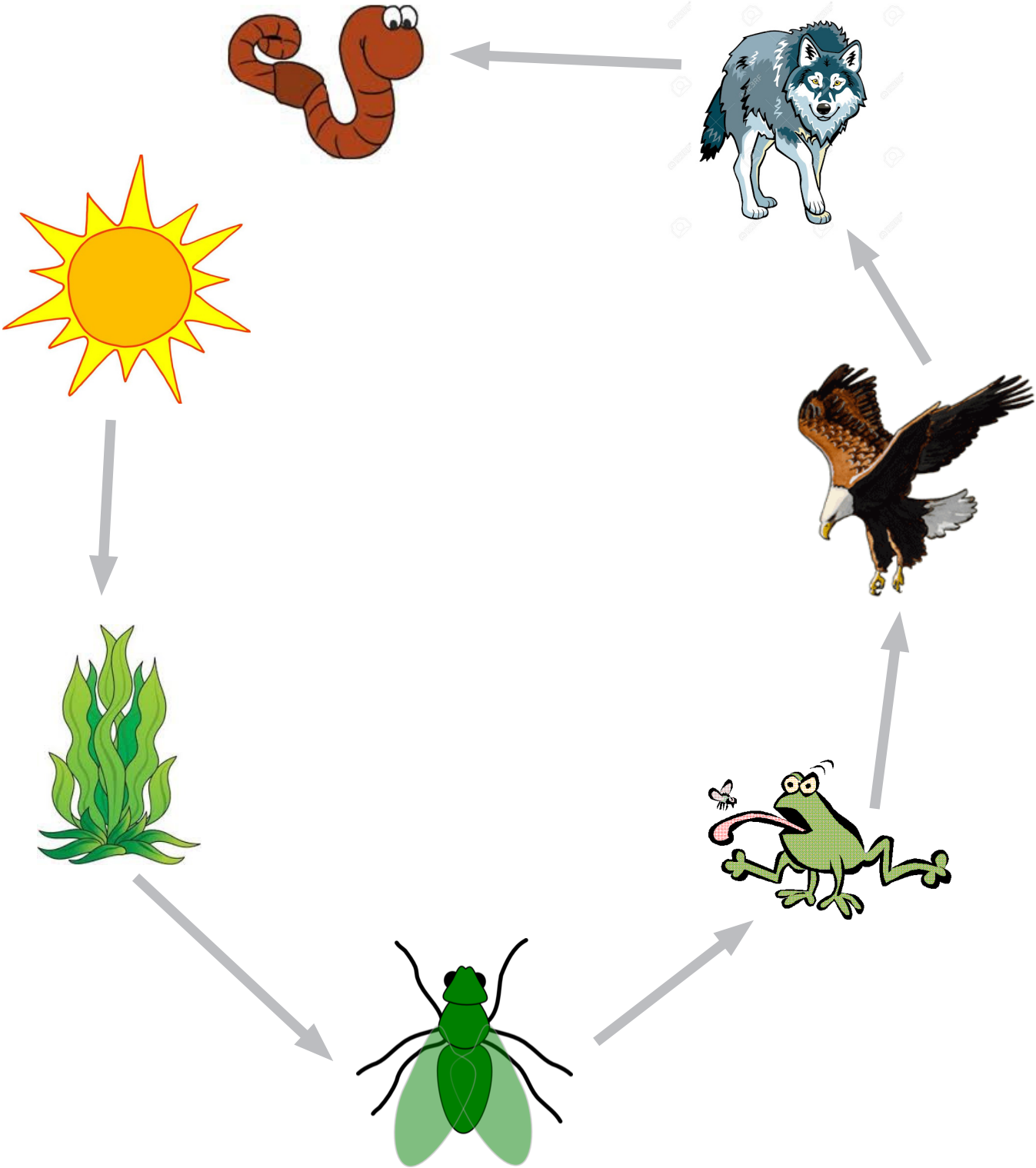
- LS2.B: Cycles of Matter and Energy Transfer in Ecosystems

Students understand that matter cycles through the ecosystem as organisms live and die

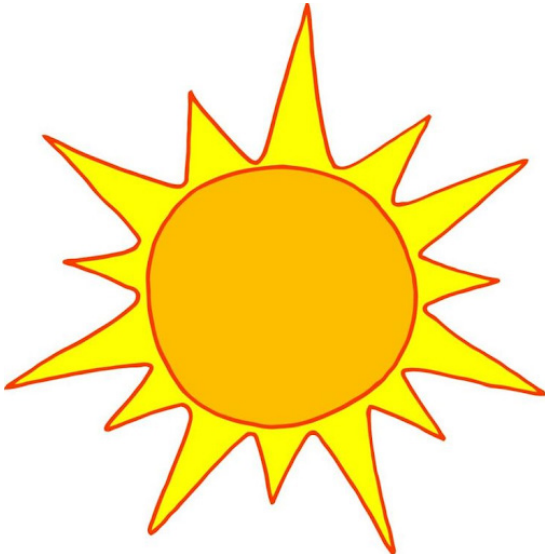
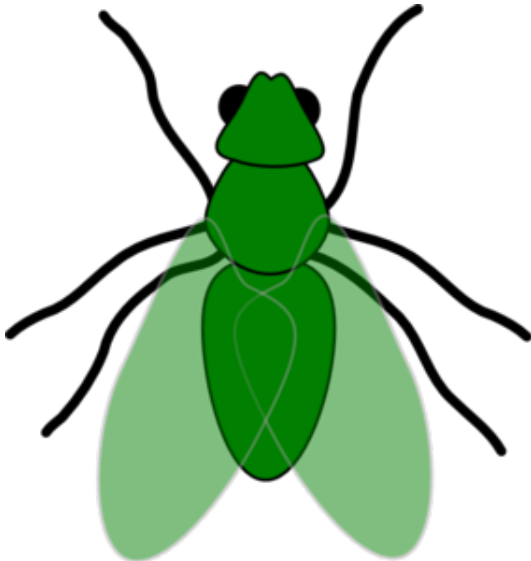
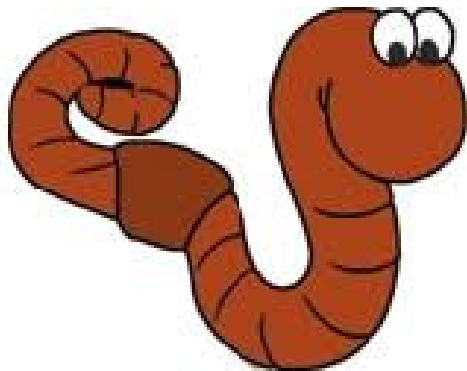




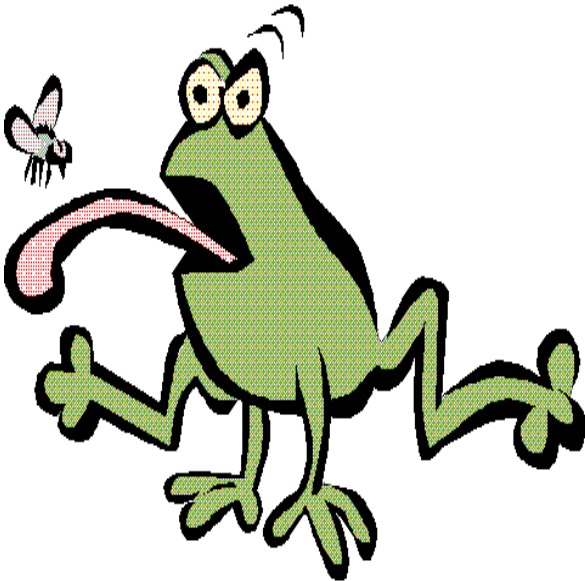
Cycle of Energy



Visual Cut-Outs



Visual Cut-Outs



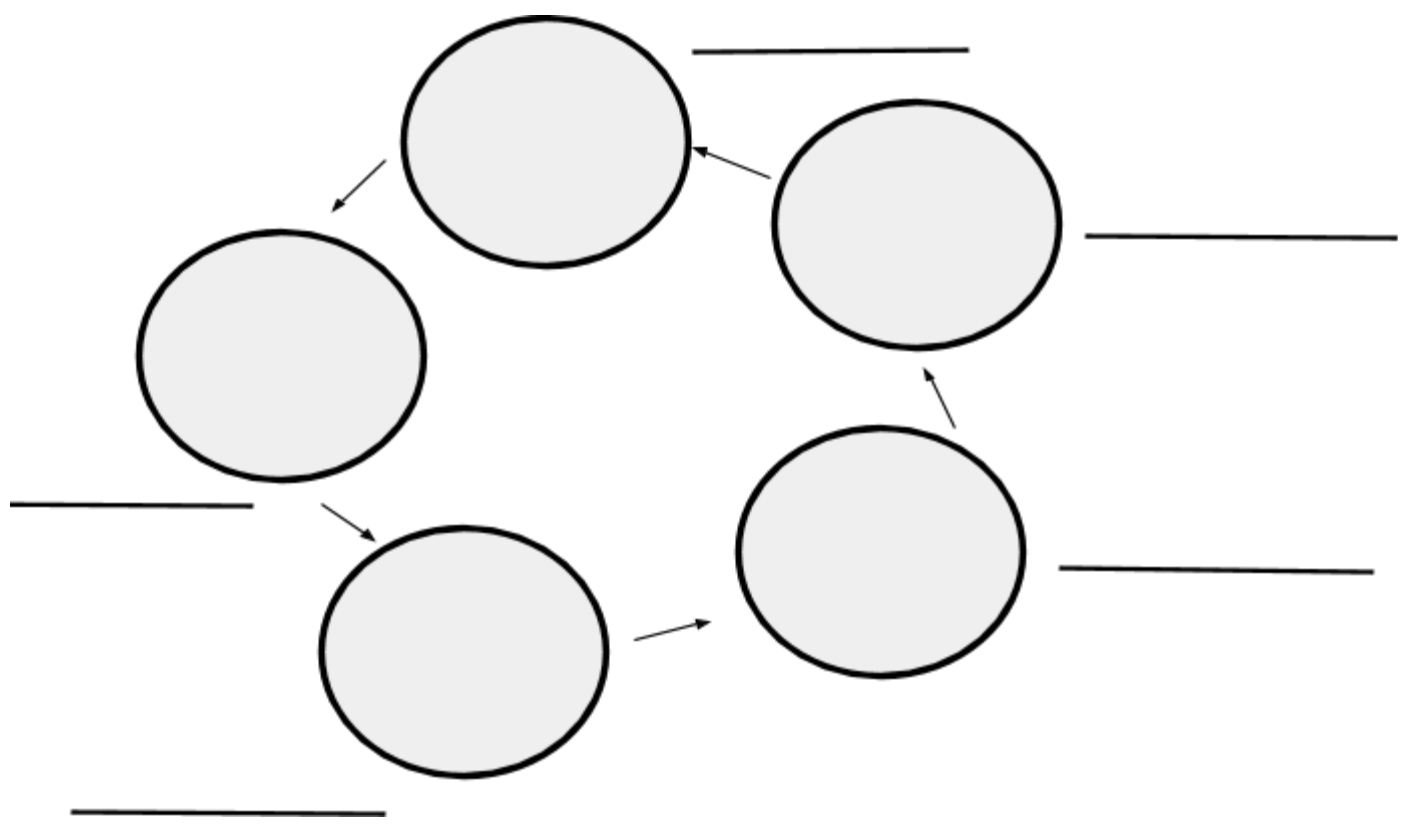
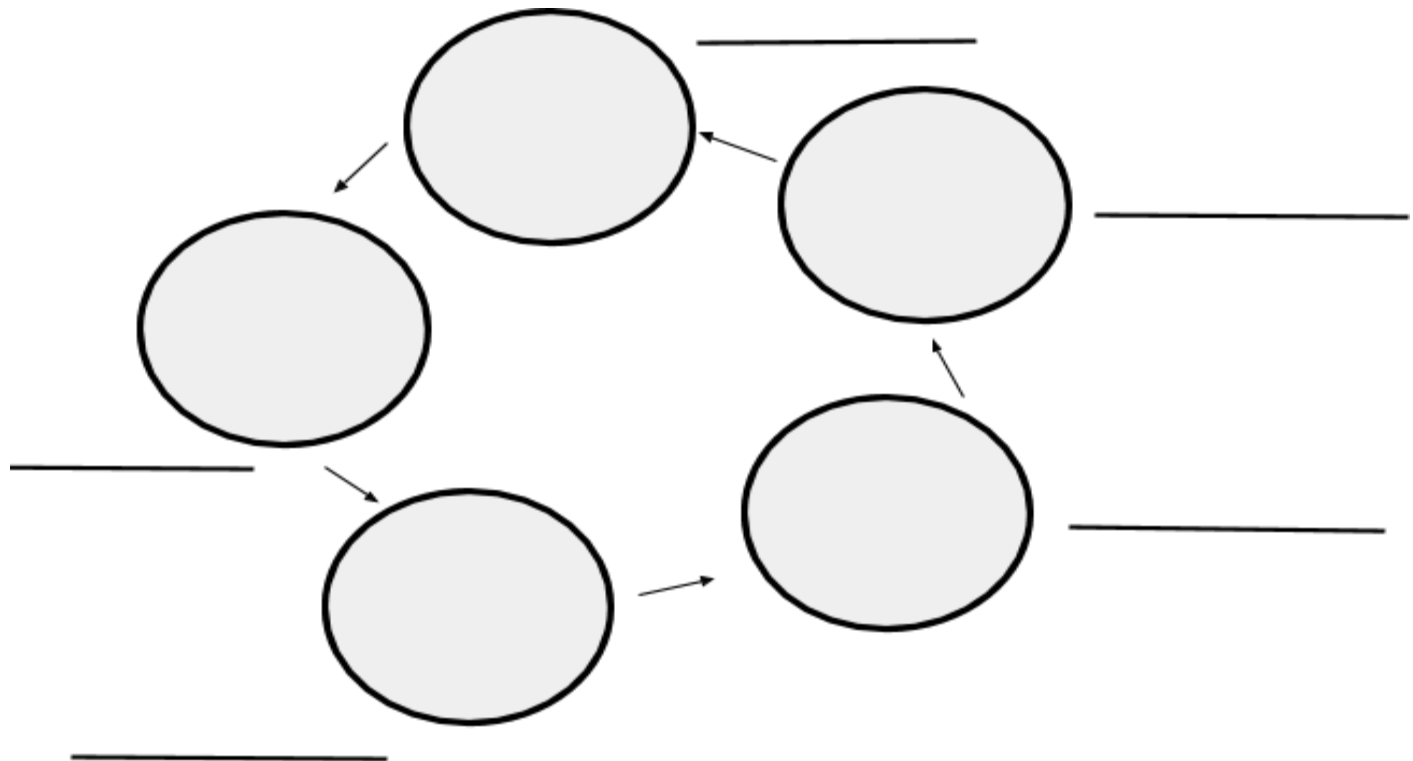
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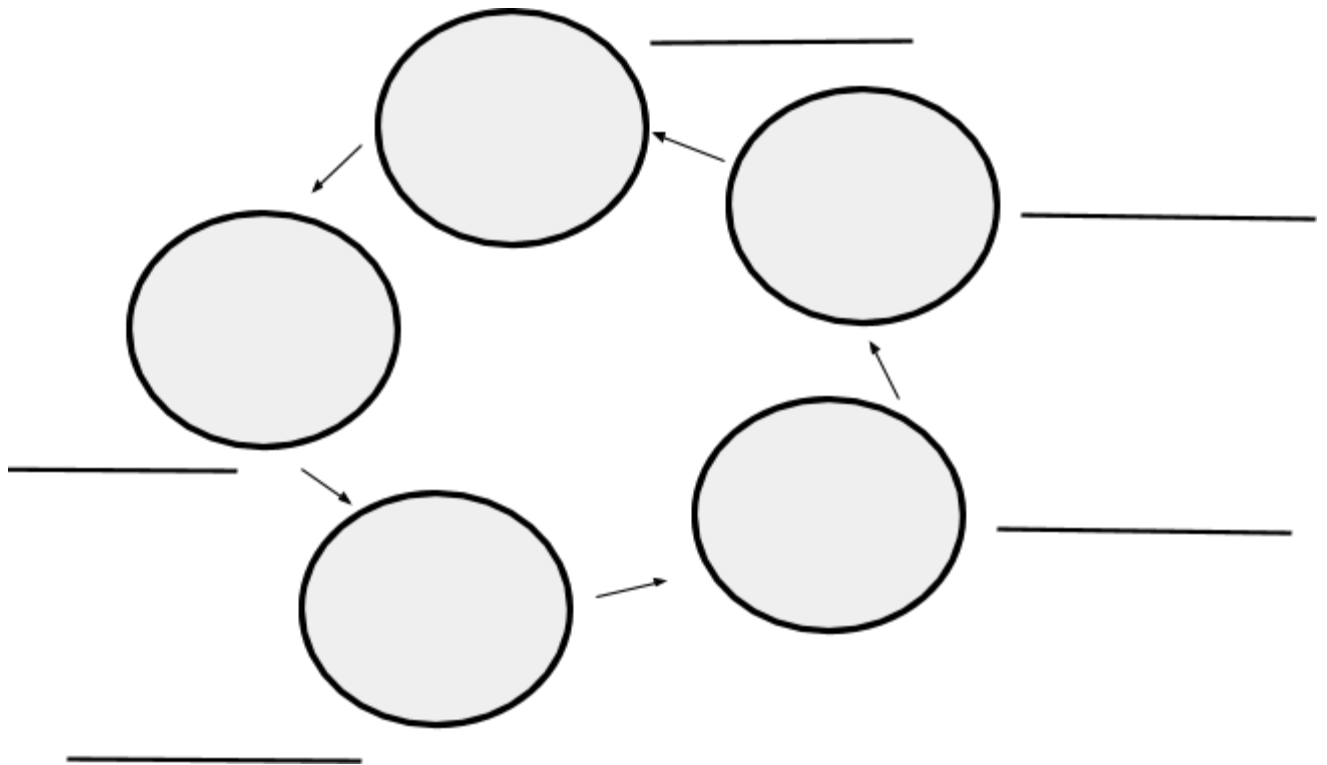
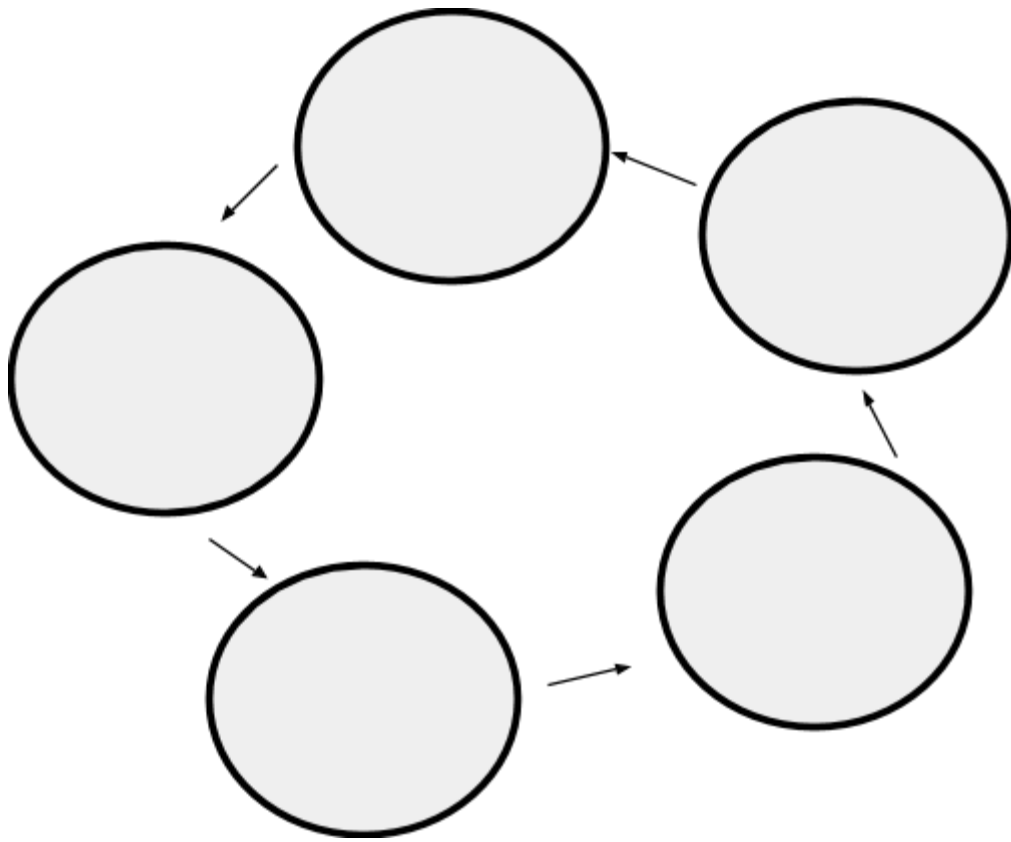
Date _____

Food Chains In Our Garden



Name _____

Date _____



Producer - an organism that gets its energy from the sun to make its own food. (Plants)

Primary consumer - an organism that mostly eats and gets its energy from producers

Secondary consumer-

an organism that eats and gets its energy from other consumers

Decomposer - an

organism that eats and gets its energy from dead or decaying things

Secondary consumer-
an organism that eats
and gets its energy
from other consumers

Secondary consumer-
an organism that eats
and gets its energy
from other consumers

.....

TITLE | HOW DO HUMANS GET ENERGY FROM OUR GARDEN?

GRADE | Fifth Grade

UNIT | 1

LESSON | 4

.....

Time: 50 - 70+ minutes

Unit Essential Question: What would our world look like without plants?

Focus Question: How do humans get energy from our garden?

Objectives: Students will be able to explain that energy comes from the sun and that humans can harness this energy.

Summary: Students attempt to answer the question, “How do humans get energy from our garden?” through the below table.

Engage	Students find similarities between solar ovens and plants.
Explore	Students observe different solar ovens and their maximum temperatures to determine ideal building materials.
Explain	Students design their ideal solar oven.
Elaborate	Students collaborate to build a solar oven.
Evaluate	Students test the solar ovens they designed using thermometers and timers.

Materials:

- Solar Oven or Photo of a Solar Oven (Below)
- Photos of Solar Oven Examples (Below)
- Optional:* Solar Cooker Simulation website²
- Worksheet (Below)
- Cardboard boxes
- Aluminum pans
- Aluminum foil
- Black construction paper
- Plastic wrap
- Wax paper
- Timers
- Thermometers
- Tape

- Scissors
- Optional: Mirror
- Optional: Plexiglass

Tips for Preparing the Lesson:

- This lesson requires a lot of preparation and materials. We recommend collaborating closely with the classroom teacher to teach this lesson.
- A local pizza store may be willing to donate pizza boxes for each pair of students. If not, you can always ask students to save used pizza boxes and to bring them into the classroom.

Prior Knowledge: Students should understand that plants use energy from the sun to grow.

Grade 5, Lesson 4: Lesson Steps

Engage: Students find similarities between solar ovens and plants.

Time: 5 mins

Materials:

- Solar Oven or
- **Photo of a Solar Oven** (Below)

Teacher

1. **Say:** We have talked about how plants and animals get their energy, but what about humans? Ask: How do humans get energy?
2. Show a solar oven or picture of a solar oven.
3. **Say:** *Today I brought in a mystery box. Your job is to figure out what this mystery box is and what it does. Take a moment to turn and talk with the student next to you about what this mystery box is.*
4. **Partners share**, then **discuss** as a whole class.
5. **Say:** *Yes, it is an oven! But this is a special oven that uses the sun's energy to cook!*
6. **Ask:** *How are solar ovens like plants?*
7. **Give** students time to reflect and respond.
8. **Summarize:** *Yes, solar ovens harness the sun's energy like plants do to make food. Today we will be designing our own solar oven that can be used to cook food from the garden.*
9. **Explain:** *Our goal today is to figure out what parts of this oven help it to cook. We will be exploring different solar ovens and figuring out what materials are most useful to include in a solar oven.*

Explore: Students observe different solar ovens and their maximum temperatures to determine ideal building materials.

Time: 8 mins

Materials:

- **Photos of Solar Oven Examples** (Below)
- *Optional:* Solar Cooker Simulation website²

Teacher

1. **Show** actual representations or pictures of different solar ovens. These can be printed and set out at stations to promote discussion, or can be viewed online using computers.
2. **Optional:** Have students view the solar cooker simulation on computers.
3. **Have** students observe materials and max temperatures while recording observations.
4. **Ask** *What makes this solar oven reach a higher temperature than this one?*
5. **Record** observations on the board about which ovens provide the most heat and what materials are best for a solar oven.

Explain: Students design their ideal solar oven.

Time: 8 mins

Materials:
- **Worksheet** (Below)

1. **Have** students design and sketch their solar oven on the worksheet provided. This can be done individually or in small groups (2-4).

Elaborate: Students collaborate to build a solar oven.

Time: 20 mins

Materials:
- Cardboard boxes
- Aluminum pans
- Aluminum foil
- Black construction paper
- Plastic wrap
- Wax paper
- Scissors
- Tape
- Mirror (optional)
- Plexiglass (optional)

1. **Lay out** materials for building solar ovens.
2. **Have** students build their design for their solar oven.

Evaluate: Students test their solar ovens using thermometers and timers

Time: 9 mins

Materials:
- Timers
- Thermometers

1. **Give** students thermometers and timers to test their solar ovens in the garden.
2. **Have** students share what materials and aspects of the oven they think are most beneficial for cooking items from the garden.
3. **Review** with students that solar ovens use energy from the sun just like plants use energy from the sun.

Lesson Extensions:

- In the next class, use the solar ovens to make garden pizzas (see *Recipes for Cooking in the Outdoor Classroom*, linked in the Table of Contents).

Grade 5, Lesson 4: Lesson Background

Key Terms:

Solar Energy - Energy derived from the sun.

Content Knowledge:

- The sun is the original source of energy in most ecosystems. Nearly all other sources of energy originally got their energy from the sun. Plants use solar energy to grow leaves, flowers and fruits. Primary consumers get energy from plants when they eat them. Some of this energy is used and some is stored in body mass. When plants and animals die, their energy is used by decomposers and over extensive time, becomes stored as oil, coal or natural gas. Sunlight also provides energy in the form of heat and light for humans, animals and plants.
- How does a solar oven work?
 - The simple answer is that it is designed to absorb more heat than it releases. Detailed teacher notes and a Q&A guide on solar cooking is available from PBS LearningMedia.⁴
- What are the basic kinds of solar cookers?
 - Three basic types of solar ovens are panel cookers, box cookers and parabolic cookers. A brief description of each is available at Insteading.com.³

Common Misconceptions:

- A common misconception is that light can only be reflected from shiny surfaces (such as a mirror). Students may also believe that an object cannot absorb and reflect light – it must do one or the other. The correct concept is that all objects absorb and reflect light to different degrees. Our ability to see objects depends on the reflection of light!

NGSS Connections:

Disciplinary Core Ideas:

- LS1.C: Organization for Matter and Energy Flow in Organisms: Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion. (secondary to 5-PS3-1)
- ETS1.B: Designing Solutions to Engineering Problems: Testing a solution involves investigating how well it performs under a range of likely conditions.(secondary to 4-ESS3-2)
- ESS3.A: Natural Resources: Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. (4-ESS3-1)

Photo of a Solar Oven (From Insteading.com³)



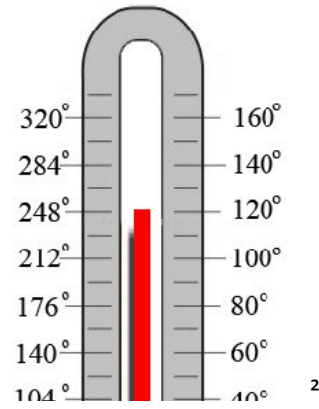
Solar Oven Examples²

Materials: Plastic Wrap, Foil, Cardboard



Your Solar Cooker
can reach:

121 °C

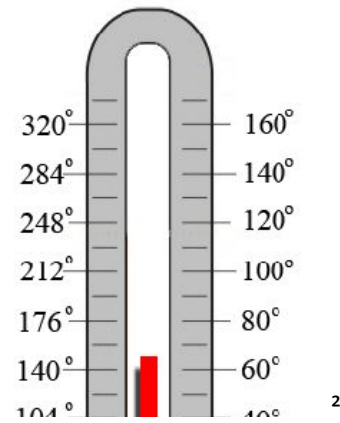


Materials: Glass, Foil, Plastic Container

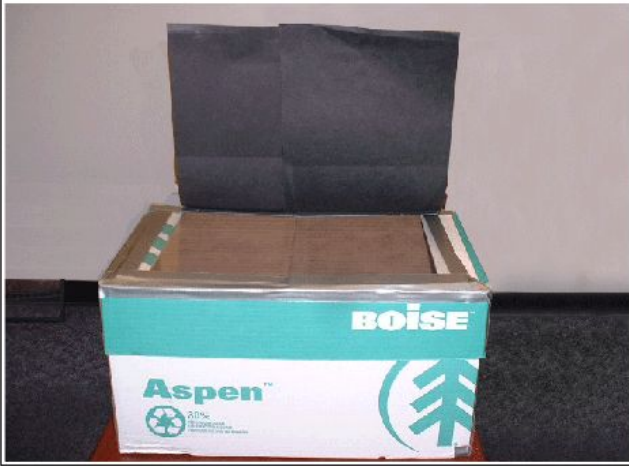


Your Solar Cooker
can reach:

65 °C

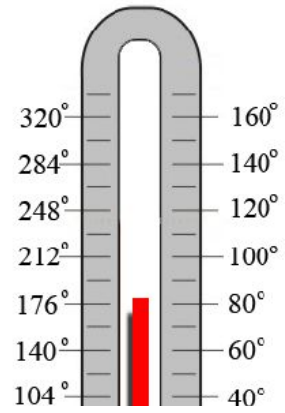


Materials: Glass, Black Paper, Cardboard



Your Solar Cooker
can reach:

82 °C



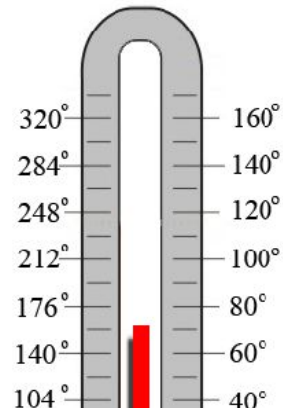
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Materials: Wax Paper, Foil, Cardboard



Your Solar Cooker
can reach:

71 °C



2

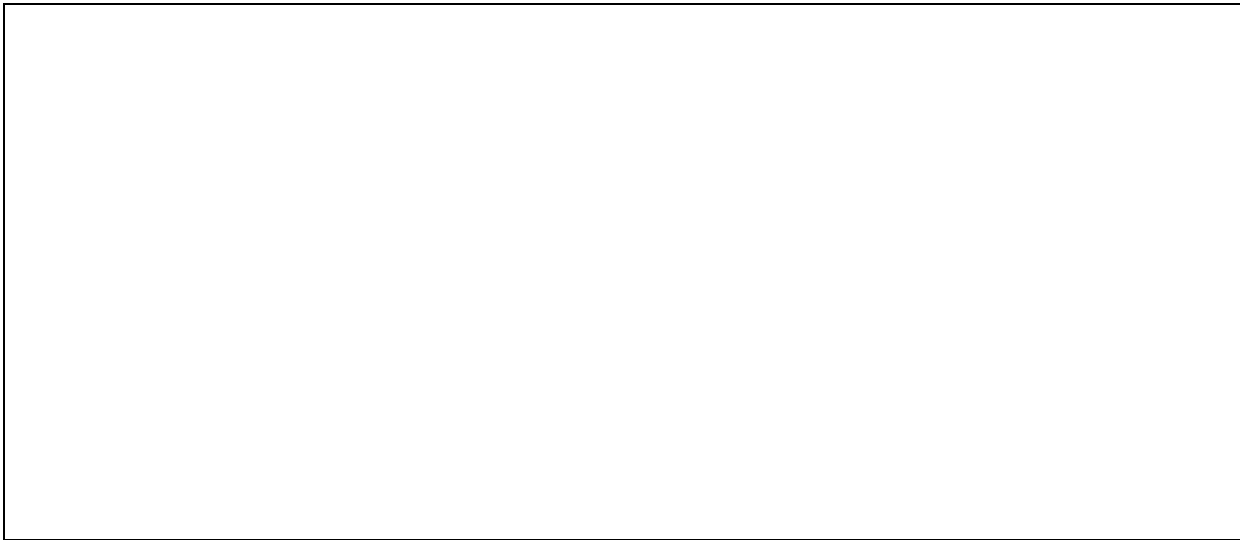
Name _____

Solar Cooking Worksheet

Look at the examples of different solar ovens. Which design do you think is best and why?

What materials will you use and why?

Sketch your solar oven design.



After 10 minutes, what temperature did your solar oven reach? _____

References:

1. NASA (n.d.). *Build a Solar Oven*. [PDF file]. Retrieved June 24, 2019, from https://www.nasa.gov/pdf/435855main_BuildaSolarOven_6to8.pdf
2. Solar Cooker Simulation. (n.d.). Retrieved June 24, 2019, from <http://www.pspb.org/e21/media/SolarCooker.html>
3. Keiren. (2018, January 04). The 4 Types of Solar Cookers. Retrieved June 24, 2019, from <https://insteadof.com/blog/solar-cooker/>
4. Solar Cooking (Teacher Notes). (n.d.). Retrieved June 24, 2019, from https://d43fweuh3sg51.cloudfront.net/media/media_files/Solar_Cooking_v105_TN.pdf