

## Food Webs Lessons: Scope and Sequence

Lesson Number	Focus Question(s)	Main Learning Goal	Science Content Storyline
1a	What is food?	Food provides matter and energy for all living things.	All living things need both matter and energy to survive. Scientists define <i>food</i> as “matter (building materials) that contains energy living things can use to live and grow, to heal wounds, and to keep all their parts working.” Only food has both of those essential components. We can find out if materials are food by analyzing whether they have mass and Calories (a measure of food energy). For example, some chewing gum is food because it is matter (measured in grams) that contains energy (measured in Calories). Some chewing gum is not food because it doesn’t have any Calories (food energy).
1b	Do living things take in (“eat”) materials that are not food? What is your evidence?	Food provides matter and energy for all living things.	Scientists define <i>food</i> as “matter (building materials) that contains energy living things can use to live and grow, to heal wounds, and to keep all their parts working.” Water, carbon dioxide (Seltzer water), plant fertilizer, salt, and vitamins aren’t food by this definition. They provide matter that living things take into their bodies, and this matter helps them. But these materials don’t provide energy that living things can use to live and grow. Therefore, they are not food by the scientific definition. On the other hand, orange juice, sugar, and mints are matter that contains food energy measured in Calories. Therefore, they are food by the scientific definition.
2a	What is food for plants? (Part 1)	Water, carbon dioxide, minerals in the soil (“plant food”), and soil are <i>not</i> food for plants because they don’t contain energy (measured in Calories) that living things can use to live and grow.	Plants need food to live and grow. To be defined as food scientifically, materials must provide matter <i>and</i> energy for living things. Water, carbon dioxide, and minerals in the soil (“plant food”) are <i>not</i> food for plants because they don’t contain energy (measured in Calories) that living things can use to live and grow. Jan van Helmont’s experiment shows us that soil is <i>not</i> food for plants because it doesn’t provide the matter that allows plants to get bigger (increase in mass). <i>So what is food for plants?</i>
2b	What is food for plants? (Part 2)	Plants are producers that make their own food by using energy from the Sun to transform matter from the air (carbon dioxide) and matter from the soil (water) into energy-supplying food.	Plants need food to live and grow. To be defined as food scientifically, materials must provide matter <i>and</i> energy for living things. Water, carbon dioxide, minerals in the soil, and soil by themselves are <i>not</i> food for plants because none of them have Calories (energy) that plants can use to live and grow. Sunlight is a form of energy, but it isn’t matter. Plants need sunlight, but sunlight by itself isn’t food for plants because it doesn’t provide matter that plants can use to build cells, leaves, stems, roots, and other structures.

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			<i>So what is food for plants?</i> Plants take carbon dioxide from the air, water from the soil, and light from the Sun and transform them into energy-supplying food matter they can use to live and grow.
3a	How do plants grow bigger?	Plants use the food molecules they make to build new body structures and grow bigger.	Plants take non-energy-supplying matter from the air (carbon-dioxide molecules) and soil (water molecules) and use energy from the Sun to change this matter into energy-supplying food matter (molecules). Plants use these food molecules to build body structures and grow bigger.
3b	How do animals grow bigger?	Animals consume the matter originally made by plants (in the form of food molecules). This matter moves from one organism to another in food chains, and each organism uses it to build body structures and grow bigger.	Plants are producers that can take non-energy-supplying matter from the air (carbon-dioxide molecules) and soil (water molecules) and use energy from the Sun to change this matter into energy-supplying food matter (molecules). Consumers (herbivores, carnivores, and omnivores) get food molecules by eating plants or other consumers that have eaten plants. Like plants, they use these food molecules (matter) to build their body structures and grow bigger.
4a	What happens to matter as it moves from organism to organism in a food chain?	<p>As matter moves from organism to organism in a food chain, the molecules get rearranged and used in different ways: for growth, to release energy, to produce wastes, and to pass food along to other organisms in the food chain.</p> <p><i>Supporting ideas:</i> Plants use carbon dioxide and water matter (molecules) to make energy-supplying food molecules. Each organism in the food chain can use those food molecules to grow bigger and release energy needed for life processes. Each organism also gives off some of that matter as wastes left on the ground or released into the air. If</p>	<p>We know from the previous lesson that plants take in matter (carbon dioxide and water) and turn it into energy-supplying food molecules with the help of energy from sunlight. And we know that plants can use this food matter to grow bigger. It can also be passed on to other organisms and used to build their bodies as they grow. But the story is more complicated than that. In addition to using the food to build their bodies and grow, organisms can break down the food molecules to release the energy they need for growth. This process produces carbon dioxide and water “wastes” that are released into the air. And some of each organism’s food matter ends up in other wastes, such as feces, urine, or plant parts that fall to the ground (leaves, branches, berries, nuts). Only some of the food inside an organism is passed on to other organisms in the food chain. So organisms use food matter in four ways: (1) to grow bigger, (2) to get the energy they need to live, (3) as waste products, and (4) as energy-supplying matter for other organisms that eat them.</p>

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		an organism is eaten by another organism, some of its food matter is passed along to that organism.	
4b	As matter moves from organism to organism in a food chain, does any of the matter disappear? What is your evidence?	Although matter changes forms and moves from organism to organism in food chains, no matter is ever lost or destroyed. The total amount of matter in the system remains the same.	In addition to using food matter to build their bodies, organisms can break down the food molecules to release the energy they need to grow. And some of each organism's food ends up in wastes, such as feces, urine, or plant parts that fall to the ground (leaves, branches, berries, nuts). Only some of the food inside an organism is passed on to other organisms in the food chain. So organisms use food matter in four ways: (1) to grow bigger, (2) to get the energy they need to live, (3) as waste products, and (4) as energy-supplying matter for other organisms that eat them. When we used linking cubes to track matter mathematically as it moved from organism to organism in a food chain, we observed that although matter changed forms and moved from organism to organism and from place to place, it was never lost or destroyed. The total amount of matter in the system remained the same.
5a	What happens to the matter that makes up wastes and dead organisms? (Part 1)	Dead organisms and parts of dead organisms break down into small pieces. This is called <i>decomposition</i> .	What happens to the wastes organisms leave behind, and what happens to dead organisms and parts of dead organisms? Do they just pile up? When we observed strawberries that were no longer part of a strawberry plant, we saw that they started to rot. This rotting process is called <i>decomposition</i> . It breaks down dead matter into many tiny pieces. We also observed mold on the strawberries and noted that the mass of the jar of fresh strawberries didn't change after the strawberries decomposed. Now we have new questions to answer: What does the mold on the strawberries have to do with decomposition? Why isn't the mass of the jar decreasing as the strawberries get smaller and smaller?
5b	What happens to the matter that makes up wastes and dead organisms? (Part 2)	Decomposers recycle matter by breaking down dead organisms into carbon dioxide, water, and minerals that plants can use again.	What happens to the wastes organisms leave behind, and what happens to dead organisms? Do they just pile up? When we observed strawberries that were no longer part of a strawberry plant, we saw that they started to rot. Organisms called <i>decomposers</i> used this once-living matter as food. The main decomposers are mold (a type of fungus) and bacteria. To get their food from wastes and dead matter, decomposers have to break down the matter into tiny pieces. They take in some of these pieces and use it as food. But they leave behind other small pieces of matter in the form of water, carbon dioxide, and minerals that enter the soil or the air. Plants can take in and use these tiny bits

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			of matter (carbon dioxide and water) to make food. Plants also use minerals from the soil to stay healthy so they can continue making food out of carbon dioxide and water. Because of the decomposers, wastes and dead matter don't just pile up! They change into a form plants can use again. For this reason, we say that matter is recycled in food chains. Matter changes forms and moves from organism to organism and between organisms and the environment, but it is never lost or destroyed.
6a	What happens to energy in food chains? Is it recycled? (Part 1)	While matter is continuously recycled in a food chain, energy <i>flows through</i> food chains, is released as heat into the environment, and is not recycled; therefore, food chains require a constant supply of new energy from the Sun to keep them going.	In food chains, energy moves from the Sun to producers and then to consumers. Producers (plants) transform light energy from the Sun into energy stored in food molecules. When herbivores eat plants, when carnivores eat other organisms, or when decomposers eat wastes and dead organisms, energy is passed from one organism to another in a food chain. Each organism uses some of this food energy to live, move, and reproduce. As organisms use the energy stored in food, they also give off heat energy into the environment. Because living things can't use this heat energy again, a constant supply of new energy from the Sun is needed in food chains. Therefore, energy <i>flows through</i> food chains, is released as heat into the environment, and is not recycled.
6b	What happens to energy in food chains? Is it recycled? (Part 2)	While matter is continuously recycled in a food chain, energy <i>flows through</i> food chains, is released as heat into the environment, and does not recycle; therefore, food chains require a constant supply of new energy from the Sun to keep them going.	In food chains, energy moves from the Sun to producers and then to consumers. Producers (plants) transform light energy from the Sun into energy stored in food molecules. When herbivores eat plants, when carnivores eat other organisms, or when decomposers eat wastes and dead organisms, energy is passed from one organism to another. Each organism uses some of this food energy to live, move, and reproduce. As organisms use the energy stored in food, they also give off heat energy into the environment. Because living things can't use this heat energy again, a constant supply of new energy from the Sun is needed in food chains. Therefore, energy <i>flows through</i> food chains, is released as heat into the environment, and is not recycled.
7a	How do living things depend on one another to get the food (matter and energy) they need to live and grow?	Living things depend on one another for the food (matter and energy) they need to survive, and they all depend on a constant supply of new energy from the Sun, since energy isn't recycled in food chains or food	Living things depend on one another to get the food (matter and energy) they need to live and grow. We've explored how organisms interact in food chains, but nature is more complicated than that! We describe these more complicated relationships as <i>food webs</i> . In food chains and food webs, organisms depend on producers to make their own food using light energy from the Sun, carbon dioxide, and water. Other organisms in food chains and food webs—consumers—can't make their own food. Therefore, consumers must get their

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		webs.	<p>food energy and matter by eating producers or other organisms that have eaten producers. Decomposers depend on all other organisms in a food chain or food web to leave behind solid wastes and die, because decomposers get their food from the waste and dead matter from producers and consumers. Producers depend on decomposers to recycle the matter (carbon dioxide and water) they need to make more food and minerals that help them stay healthy. All organisms ultimately depend on a constant supply of light energy from the Sun so that producers can make more food. Because energy isn't recycled in food chains or food webs, a constant supply of new light energy is needed.</p>
7b	How do living things in a mini-environment get the food matter and energy they need to live and grow?	Living things depend on one another and their environment for the food matter and energy they need to survive.	<p>Living things in a mini-environment depend on one another to get the food matter and energy they need to live and grow. Producers (mostly plants) get food matter and energy by making their own food using light energy from the Sun and carbon dioxide and water they get from their environment. To continue making food, producers depend on decomposers to recycle matter (carbon dioxide, water, minerals). Other organisms in a food web—consumers—can't make their own food. Therefore, all consumers depend on plants. Herbivores get their food energy and matter by eating producers directly; carnivores get matter and energy by eating other consumers that have eaten plants. Decomposers get their food matter and energy from the wastes and dead materials producers and consumers leave behind. Bacteria are a type of decomposer that leave behind tiny bits of matter (carbon dioxide, water, and minerals) that plants can use again to make more food and keep the cycle going. Because of decomposers' recycling work, plants don't run out of the matter they need to make food. But energy isn't recycled, so a constant supply of new energy from the Sun is needed. All living things depend on producers (plants) because they're the only organisms that can capture energy from the Sun and transform it into food energy that gets passed to all organisms in a food web and provides them with the matter and energy they need to survive.</p>