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**Topic**

Food chains

**Key Question**

What is the primary source of matter and energy entering most food chains?

**Learning Goal**

Students will learn that plants are the main source of matter and energy entering most food chains.

**Guiding Documents**

*Project 2061 Benchmarks*

- *Almost all kinds of animals' food can be traced back to plants.*
- *Food provides the fuel and the building material for all organisms. Plants use the energy from light to make sugars from carbon dioxide and water. This food can be used immediately or stored for later use. Organisms that eat plants break down the plant structures to produce the materials and energy they need to survive. Then they are consumed by other organisms.*
- *Some source of "energy" is needed for all organisms to stay alive and grow.*

*NRC Standards*

- *All animals depend on plants. Some animals eat plants for food. Other animals eat animals that eat the plants.*
- *Populations of organisms can be categorized by the function they serve in an ecosystem. Plants and some microorganisms are producers—they make their own food. All animals, including humans, are consumers, which obtain food by eating other organisms. Decomposers, primarily bacteria and fungi, are consumers that use waste materials and dead organisms for food. Food webs identify the relationships among producers, consumers, and decomposers in an ecosystem.*
- *For ecosystems, the major source of energy is sunlight. Energy entering ecosystems as sunlight is converted by producers into stored chemical energy through photosynthesis. It then passes from organism to organism in food webs.*

**Science**

Environmental science  
food chains

**Integrated Processes**

Observing  
Comparing and contrasting  
Drawing conclusions  
Relating

**Materials**

Box or wastepaper can filled with scratch paper  
Labels (see *Management 3*)  
*Chain Games* Cards  
*Food Chain Key*  
Scissors

**Background Information**

Food chains exist in all habitats and can be used to demonstrate the complexity and energy flow in an ecosystem. Producers capture the sun's energy to make their own food in plant form, while consumers rely on eating those plants or other consumers to get their energy. When an animal eats a plant, it only receives 10% of the energy that the plant got from the sun. Likewise, when an animal eats another animal, it only receives 10% of the energy that animal got from the plants or other things it ate. This 90% energy loss at each level of a food chain is the reason there are so many low-level (primary) consumers and so few top-level consumers.

**Management**

1. This activity is divided into two parts. In the first part, students will play a game in which they toss a ball of wadded scratch paper to see the loss of energy along the food chain. In the second part, students will play a card game in which they build food chains.
2. Copy the cards on card stock. You may wish to laminate the cards for durability.
3. Make labels on paper or 5" x 7" cards that say *Sun, Grass, Deer, Wolf, Cheese, Mouse, and Cat.*
4. The *Chain Games* cards can be linked together in several different ways. For example, a hawk might eat a rabbit, a snake, or a smaller bird. Use the *Food Chain Key* to help identify the things that each animal eats.
5. The concentration card game can be played by two to four students. Adjust the number of card sets needed by the number of groups you have.

## Procedure

### Part One

1. Ask the students if they are feeling energetic. Have them name some of the things they have already done today, and ask if doing these things took any energy. See if they can identify a source from which they get all the energy they use. If necessary, guide the discussion to identify food as the energy source, and point out that it takes energy just to do the things we need to stay alive, such as breathing and enabling the other systems of our bodies to function.
2. Ask if they know where the energy in food comes from, making note of some of the possibilities suggested.
3. Select four students to stand side by side in a line in front of the class. Hand a ball made from four pieces of wadded scratch paper to the first student. Ask the students to pass the ball along the line with each person removing a sheet of the paper. The last person should hold on to the single sheet that is left.
4. Explain that the ball represents energy. Distribute labels to identify the first person as the sun, the second as grass, the third as a deer, and the fourth as a wolf. Return the energy ball to the sun and have the students pass it along again as you explain that (1) energy comes from the sun, (2) the grass uses that energy to make and store food in its cells, (3) the deer eats the grass, getting some of the stored energy along with the food matter, and (4) the wolf eats the deer, getting some of the energy that was stored in the deer's cells. Emphasize that the living parts of this arrangement—the plants and the animals—form what is called a food chain.
5. Keep the sun and the grass in place, have students return the wadded paper to make a new energy ball, and ask the other two students to return to their seats. Pick three more students, one to represent cheese (clarifying that cheese is made from milk that comes from a cow), one to represent a mouse, and one to represent a cat. Ask the class to arrange the five students in the order of a food chain. When the order is agreed upon, direct the sun to pass the energy ball along the chain again. As the energy ball moves from link to link, have the students remove paper from the energy ball, and ask them to explain how the energy is being passed along from organism to organism.
6. Ask the class to identify what is the same about the two food chains [sun, grass] and what is different [the animals].
7. Tell the students that the entire class will form a circle around the wastepaper can that contains scratch paper. Inform them that the scratch paper

represents energy from the sun. Explain that the student who begins the toss will select four or five pieces of scratch paper and wad them up into a ball that he or she tosses to a classmate. When the classmate catches the ball, the classmate must call out what link he or she represents in the food chain. (The first link needs to be a producer such as grass or leaves.) Then that child removes a piece of the paper and tosses the ball to another student. The student who catches it must call out the name of a consumer and remove a piece of the paper. Students will continue tossing and removing the paper until the chain can go no further (usually three to five links). When the chain is finished, tell the students that they will begin again. Invite a student who has not caught the paper ball to go to the wastepaper can and form a new energy ball to begin the process again.

9. After all students have had the opportunity to catch the energy ball and call out a producer or consumer name, inform the class that they will play a card game to look further into food chains.

### Part Two

1. Distribute one set of *Chain Games* cards to each group and have students cut out the cards.
2. Have students shuffle the cards and lay them face down on a desk or table in ordered rows and columns.
3. Explain the rules of the game to students and allow them to play several rounds.

### Rules

1. This game is played like the commercial "Memory" or "Concentration" games, but instead of looking for matching cards, players are looking for food chains.
2. Each player's turn begins by turning any two cards face up. If either of these cards begins or continues an existing food chain, the player takes the card(s). For example, any time a player turns over a sun, he/she will take that card because the sun is at the beginning of every food chain.
3. If only one of the two cards can be used by a player, the unusable card is turned face down (in the same location) and the player's turn is over. If a player can use both of the turned over cards, he/she continues to turn cards over, one at a time, until a card that he/she cannot use is turned over. At that point, his/her turn is over, the unusable card is placed face down (in the same location) and the next player's turn begins.
4. All food chains must begin with the sun followed by a producer. The subsequent orders of the animals in the food chains can vary, as indicated by the *Food Chain Key*.

5. Players may have multiple food chains going at the same time. They must always keep all food chain cards they have collected face up and arranged in the correct order. This will allow them, and all of the other players, to quickly determine whether or not the card(s) they turn over can be taken.
6. The game ends when there are no more food chains that can be created using the remaining cards. The player with the most cards at the end of the game is the winner.

### Connecting Learning

1. Could plants ever be anywhere in a food chain except at the beginning? [No.] Explain. [They can only get their energy directly from the sun, since they make their own food.]
2. Could animals ever be at the beginning of a food chain? Why or why not? [No, because they can't make their own food, so they have to get their energy by eating a plant or another animal.]
3. Which plants have you noticed at the beginning of several different food chains? Why do you think this is so?
4. Which plants are at the beginning of the food chains that include you?
5. What are you wondering now?

### Curriculum Correlation

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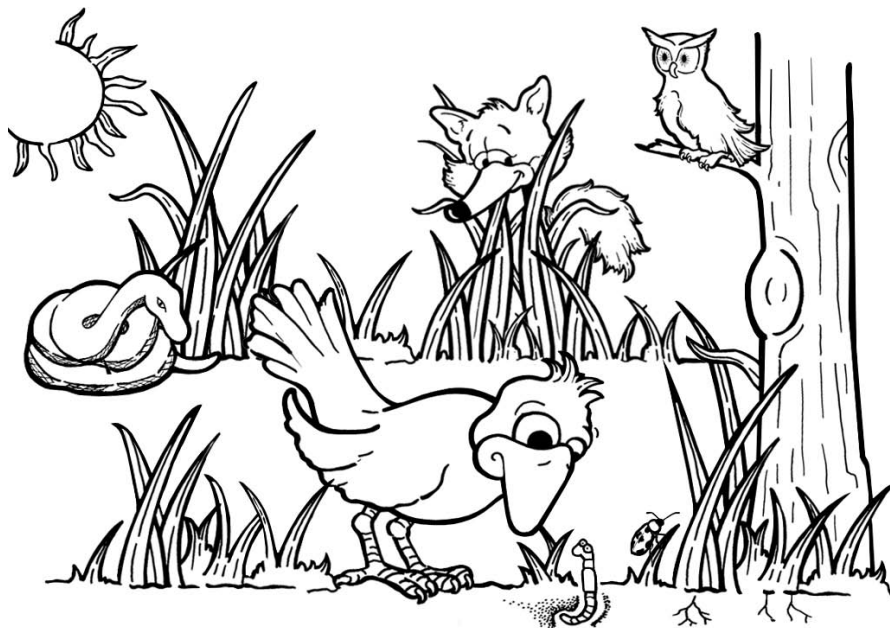
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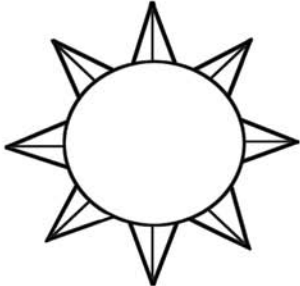
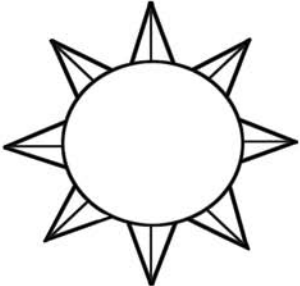
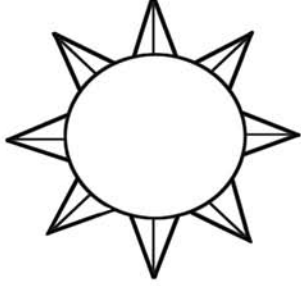
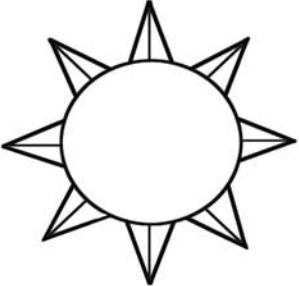
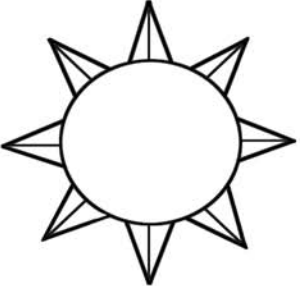
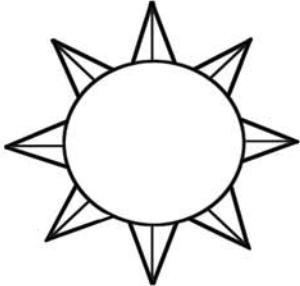






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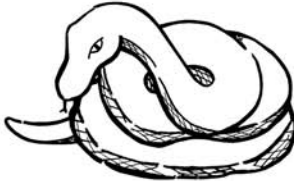

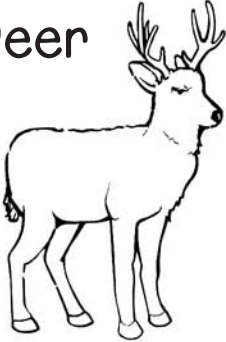

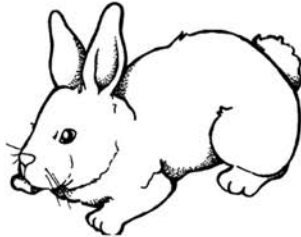





# CHAIN Games

Sun 	Sun 	Sun 
Sun 	Sun 	Sun 
Grain 	Grain 	Grain 
Leaves 	Grass 	Grass 









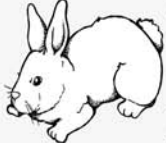





# CHAIN Games

Owl 	Hawk 	Cat 
Toad 	Snake 	Cow 
Deer 	Leaf Beetle 	Rabbit 
Man 	Mouse 	Sparrow 

# CHAIN Games

## Food Chain Key

<p>Owl</p> 	<p><b>What it eats:</b> Frog Sparrow Snake Mouse</p>	<p>Hawk</p> 	<p><b>What it eats:</b> Snake Sparrow Mouse Frog Rabbit</p>	<p>Cat</p> 	<p><b>What it eats:</b> Frog Snake Sparrow Rabbit Mouse</p>
<p>Toad</p> 	<p><b>What it eats:</b> Leaf beetle</p>	<p>Snake</p> 	<p><b>What it eats:</b> Frog Mouse</p>	<p>Cow</p> 	<p><b>What it eats:</b> Grain Grass</p>
<p>Deer</p> 	<p><b>What it eats:</b> Grain Leaves Grass</p>	<p>Leaf Beetle</p> 	<p><b>What it eats:</b> Leaves</p>	<p>Rabbit</p> 	<p><b>What it eats:</b> Grain Grass Leaves</p>
<p>Man</p> 	<p><b>What it eats:</b> Cow Rabbit Deer Grain</p>	<p>Mouse</p> 	<p><b>What it eats:</b> Grain</p>	<p>Sparrow</p> 	<p><b>What it eats:</b> Grain Leaf beetle</p>