Energy Flow

Lesson Concept Energy flows through a food chain.

Link In the previous lesson, students reviewed the basic components of a food chain: producer, consumer, decomposer and the concept that matter cycles through a food chain. In this lesson, students are introduced to the idea that energy flows through a food chain. In the next lesson, students learn that food chains combine to make food webs.

Time 60 minutes

Materials

Per Group (groups of 4)

1 Liter bottle of soda (or colored water)

3 100 ml Graduated cylinders (or small jars/cups)

1 Large plastic tub

Energy Flow Cards

Individual

Science notebooks

Food pyramid puzzle pieces

Advance preparation

1. Gather materials.
2. Print and cut a set of energy flow cards for each group.
3. Duplicate food pyramid and cut into pieces by slicing on the horizontal lines; make sure the completed puzzle fits in a science notebook.

Procedure:

Engage ***(5 minutes) Living things need energy.***

1. Write the word energy on the board. Ask students to discuss how food chains help living things get and use energy. Chart their ideas.
2. Ask students to recall the components of a food chain and explain that today students will use a model of a food chain to learn about the flow of energy in a food chain.

Explore/Explain ***(30 minutes) In a food chain only 10% of the available energy is passed to the next component of a food chain.***

3. Ask students to form groups of 4 and chose which role they want to play: sun, a plant (producer), a rabbit (consumer), and a hawk (consumer).

4. Label the rabbit as a primary consumer and the hawk as a secondary consumer. Ask students what these names mean (the order in which food is eaten).
5. Ask the "sun" to hold the 1 liter bottle of soda. Explain that the bottle of soda represents the energy available from the sun.
6. Have the students use the Energy Flow Cards in order from #1-4 to experience energy flow in an ecosystem.
7. Have groups read card #1 and perform the action (plant pours 100mls of soda into plant's graduated cylinder).
8. Bring the groups back together to ask what this action represents: they began with a 1liter bottle (1000 mls) and poured 100mls into the cylinder. How much does this represent? It represents a part—$1/10^{th}$ of the whole. In a simple food chain a plant gets 1/10 of the energy available from the sun.
9. Ask groups to now read and do the action on card 2 (rabbit pours 10mls of plant's soda into rabbit's graduated cylinder).
10. Bring the groups back together and ask how this action was similar to the first—the same amount of "energy", $1/10^{th}$ was passed. Ask how this action was different—this time it was the rabbit that only got 1/10 of the energy from the plant.
11. Ask groups to now read and do the action on card 3 (hawk rabbit pours 1ml of rabbit's soda into hawk's graduated cylinder).
12. Bring the groups back together and ask how this action was similar to the first—the same amount of "energy", $1/10^{th}$ was passed. Ask how this action was different—this time it was the hawk that only got 1/10 of the energy from the rabbit.
13. Read and do the action on card #4 as a class and discuss that this action represents the remaining energy that has now been changed to heat and is not available to the plants and animals in the ecosystem.
14. Process the activity: Ask students how energy flowed through the food chain. How much energy was passed at each level? Help students recognize that only a tiny fraction of the energy once observed during photosynthesis has been maintained and stored in the top carnivores.

Extend/Evaluate ***(15 minutes) Energy Flow is represented as a food pyramid, showing the energy relationship between different level components.***

15. In partners, ask students to discuss this activity and answer this question: In a healthy ecosystem are there more producers or top consumers? Why? (More producers because more energy, less consumers because less energy available.)
16. Ask partners to share out using this sentence frame: We think_____will be the largest group because_____, and we think_____will be the smallest group because_____.

17. Distribute the food pyramid puzzle to each student. Ask students to assemble the puzzle in their notebook. Using what they know about the flow of energy, explain why the shape of this puzzle is a pyramid.
18. Ask them to explain what they think would happen to the pyramid if one of the levels was removed (producers, for example).

Energy Flow Cards

Card #1: Through the interaction of biotic and abiotic components, nutrients and energy flow through ecosystems. Plants collect the sun's energy with their leaves and use it to transform water and carbon dioxide into high-energy carbohydrate molecules.

Action: Have the “plant” pour 100 ml of the “sun’s” soda into the “plant’s” graduated cylinder.

What does this action represent?

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Card #2: When an animal consumes these molecules (such as when a rabbit eats a carrot), the stored energy is released and helps to fuel the animal's cellular activities, including the production of new molecules, cells, and tissues.

Action: Have the “rabbit” pour 10 ml of the soda from the “plants” graduated cylinder into the “rabbit’s” graduated cylinder.

What does this action represent?

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Card #3: If a secondary consumer then eats primary consumer (for example, if a hawk eats the rabbit), the secondary consumer will in turn be fueled by the energy stored in the primary consumer’s tissues. In this way the solar energy originally collected by plants is transferred from one organism to another.

Action: Have the “hawk” pour 1ml of the soda from the “rabbit’s” graduated cylinder into the “hawk’s” graduated cylinder.

What does this action represent?

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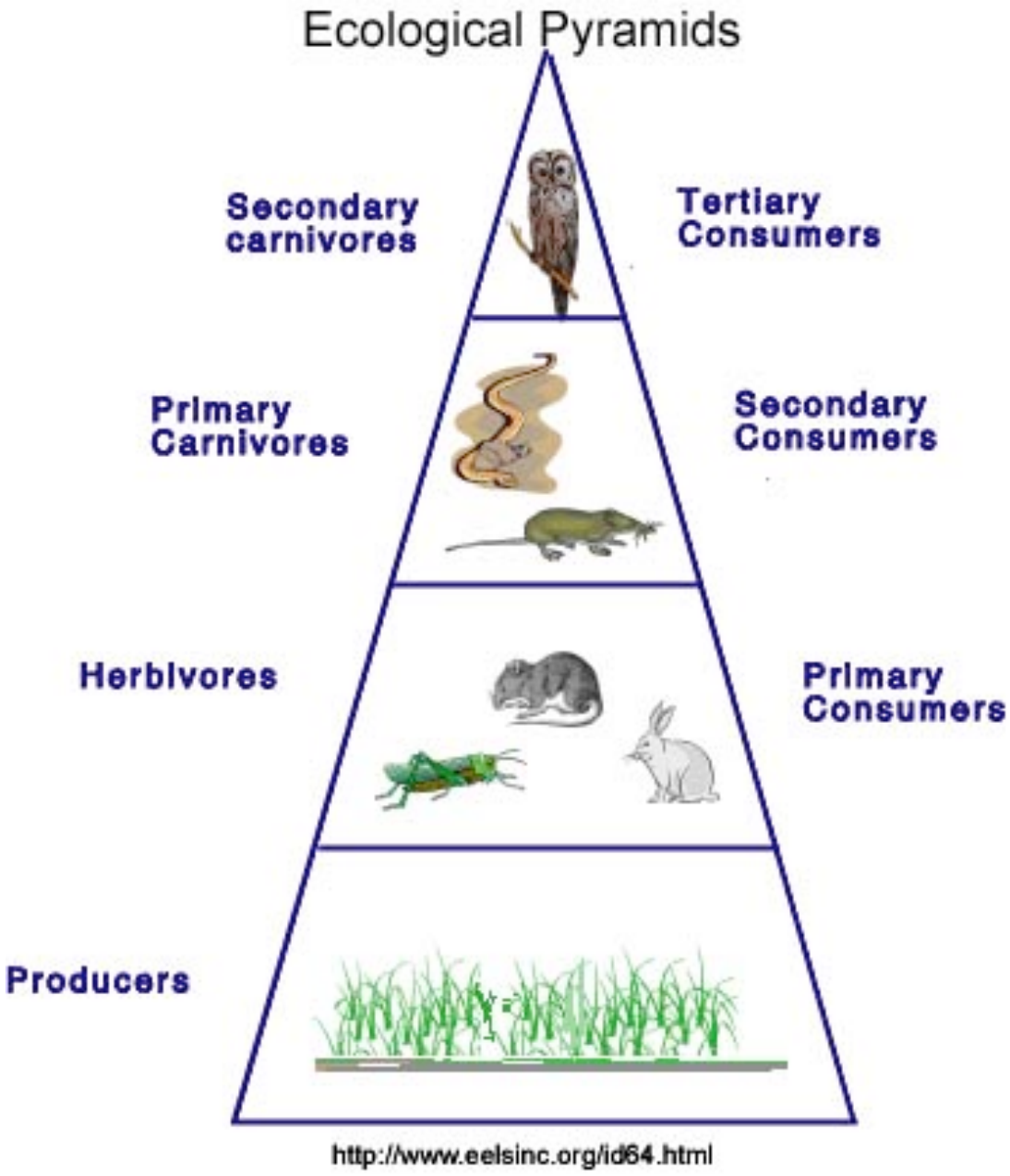
Card #4: How much soda is left in the bottle?

Action: Pour the remaining soda into the plastic tub.

What does this action represent?


Ecological Pyramids
Secondary carnivores
Tertiary Consumers
Primary Carnivores
Secondary Consumers
Herbivores
Primary Consumers
Producers
http://www.eelsinc.org/id64.html