Prairie Energy Pyramid

Trace energy through a food chain and explain the shape of its model.

ENV.1.3 "Use models to explain why the flow of energy through an ecosystem can be illustrated by a pyramid with less energy available at the higher trophic levels compared to lower levels."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the four energy amounts, circle two reasons energy does not pass to the next consumer, and number the organisms in the food chain from 1 at the pyramid's base to 4 at its top.

A Summer on the Prairie

1. At the edge of a prairie, sunlight falls on grasses. The grasses capture some light energy and store it in sugars as they grow. Grasshoppers eat grass, meadowlarks eat grasshoppers, and hawks can eat meadowlarks. This chain names who gets energy from whom, but it does not show how much energy can pass along. Imagine measuring the energy stored in new growth at each level during one summer. To compare the levels, draw a four-layer pyramid with grass at the bottom and hawks at the top. Each layer stands for the energy available to organisms at that level.

2. In a simplified summer model, prairie grasses store 12,000 energy units in new growth. Grasshoppers store 1,200 units from eating those grasses. Meadowlarks store 120 units from eating grasshoppers, and hawks store 12 units from eating meadowlarks. These numbers show one possible pattern, not a fixed rule that every ecosystem follows. A pyramid's wide base represents the large amount of energy stored by producers. Higher layers become narrower as the energy available to consumers decreases. The shape compares energy at each feeding level, not the size of an individual grasshopper or hawk.

3. Why does so little energy reach the hawks? At each level, organisms use stored energy to move, maintain their bodies, and carry out other life processes. Much of the energy they use eventually leaves as heat. Not every part of an organism is eaten, and not every eaten part is digested. Energy in uneaten or undigested material can pass to decomposers instead of the next consumer in this chain. The pyramid is a model: it leaves out many feeding connections, but it makes one pattern clear. Less energy is stored in new growth at each step up this food chain.

2 ANSWER WITH EVIDENCE

Use the passage

1. If you draw the grass layer 10 cm wide to represent 12,000 energy units, how wide should you draw the grasshopper layer using the same scale? Explain.

2. Why does the meadowlark layer belong below the hawk layer, and which layer should be wider?

3. A student claims that all 1,200 energy units in grasshoppers move to meadowlarks. Use the model and one energy pathway from the passage to correct the claim.

4. If someone drew the hawk layer wider than the grass layer, what would that suggest about energy? Why would it conflict with this model?

3 YOUR TURN

Your own words

In the box, draw a four-layer energy pyramid for a pond chain: algae, zooplankton, small fish, and heron. Put algae at the base with 8,000 energy units, choose a smaller amount for each higher layer, and write two sentences explaining the pyramid's shape and where energy goes between levels.

ANSWER KEY

Prairie Energy Pyramid

PART 1 · READ AND MARK

Underline the four energy amounts, circle two reasons energy does not pass to the next consumer, and number the organisms in the food chain from 1 at the pyramid's base to 4 at its top. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	If you draw the grass layer 10 cm wide to represent 12,000 energy units, how wide should you draw the grasshopper layer using the same scale? Explain.	**The grasshopper layer should be 1 cm wide because 1,200 units is one-tenth of 12,000 units.**
2	Why does the meadowlark layer belong below the hawk layer, and which layer should be wider?	**Meadowlarks are eaten by hawks, so their layer belongs below the hawk layer. The meadowlark layer should be wider because it has 120 energy units, compared with 12 for hawks.**
3	A student claims that all 1,200 energy units in grasshoppers move to meadowlarks. Use the model and one energy pathway from the passage to correct the claim.	**Only 120 units are stored by meadowlarks in this model. Grasshoppers use energy for life processes, and much of that energy eventually leaves as heat.**
4	If someone drew the hawk layer wider than the grass layer, what would that suggest about energy? Why would it conflict with this model?	**It would suggest that more energy is available to hawks than to grasses. That conflicts with the model's 12 units for hawks and 12,000 units for grasses.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Pyramid labels, base to top: algae, 8,000 units; zooplankton, 800 units; small fish, 80 units; heron, 8 units. Each layer narrows because less energy is stored at the next feeding level. Organisms use energy for life processes, much of which eventually leaves as heat, and some energy remains in material the next consumer does not eat or digest.

Accept any pyramid with the organisms in the stated feeding order, 8,000 units at the base, and decreasing amounts above it. The explanation should connect narrower upper layers to reduced energy transfer and identify at least one pathway for energy that does not reach the next consumer.