LESSON MAKER PRO

Energy and Matter Math

Use proportions to track biomass energy and conserved atoms.

HIGH SCHOOL · HS-LS2-4

HS-LS2-4 "Use a mathematical representation to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. Clarification Statement: Emphasis is on using a mathematical model of stored energy in biomass to describe..."

NAME _____ DATE _____

PART 1: PRACTICE

Multiply stored energy or matter by the transfer fraction. Energy not stored at the next level is used or released as heat, but atoms remain in the ecosystem and move into other organisms or reservoirs.

WORKED EXAMPLE

Moss stores 5,000 kJ. A model shows that 12% becomes insect biomass. How much energy is stored in insects?

1. 12% = 12/100.
2. 5,000 x 12/100 = 600.
3. The insects store 600 kJ.

Answer: 600 kJ

PRACTICE 5 problems

1 Algae store 2,400 kJ. If 10% becomes herbivore biomass, how much energy is stored in herbivores?

ANSWER _____

2 A plant contains 80 g of carbon. If 1/4 enters caterpillar biomass, how much carbon enters the caterpillars?

ANSWER _____

3 Producers store 3,600 kJ. If 5% transfers to primary consumers, how much energy transfers?

ANSWER _____

4 A hawk stores 72 kJ, which is 20% of the energy stored by its prey. How much energy do the prey store?

ANSWER _____

5 Leaves contain 45 g of nitrogen. If 2/3 returns to the soil through decay, how much nitrogen returns to the soil?

ANSWER _____

APPLY IT Show your work

1 A school garden's tomato plants store 4,800 kJ. A model estimates that 10% becomes aphid biomass, then 1/4 of the aphid energy becomes ladybug biomass. A student claims that ladybugs store 120 kJ. Is the claim supported?

WORK SPACE

ANSWER _____

2 At a community compost project, plants contain 150 kg of carbon. A model says 2/5 enters caterpillar biomass and 1/3 of that enters bird biomass. How much carbon is in bird biomass? Why has the other carbon not disappeared?

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

A pond model begins with 8,000 kJ of producer energy and 120 g of producer carbon. Ten percent of the energy reaches snails, then 25% of snail energy reaches fish. Separately, 1/4 of producer carbon enters snail biomass, and fish biomass contains 6 g of carbon. Are these claims supported: fish store 200 kJ and received 1/5 of the snail carbon? Explain how energy and carbon differ after transfer.

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ANSWER KEY

Energy and Matter Math

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Algae store 2,400 kJ. If 10% becomes herbivore biomass, how much energy is stored in herbivores?	**240 kJ**
2	A plant contains 80 g of carbon. If 1/4 enters caterpillar biomass, how much carbon enters the caterpillars?	**20 g**
3	Producers store 3,600 kJ. If 5% transfers to primary consumers, how much energy transfers?	**180 kJ**
4	A hawk stores 72 kJ, which is 20% of the energy stored by its prey. How much energy do the prey store?	**360 kJ**
5	Leaves contain 45 g of nitrogen. If 2/3 returns to the soil through decay, how much nitrogen returns to the soil?	**30 g**

PART 2 · APPLY IT

1. **Yes. Ladybugs store 120 kJ.** 4,800 x 1/10 = 480 kJ in aphids. Then 480 x 1/4 = 120 kJ in ladybugs.
2. **20 kg of carbon. The other carbon remains in other biomass, waste, or environmental reservoirs.** 150 x 2/5 = 60 kg in caterpillars. Then 60 x 1/3 = 20 kg in birds.

CHALLENGE

Yes. Snails receive 800 kJ, and fish receive 200 kJ. Snails contain 30 g of carbon, and 6/30 = 1/5 reaches fish biomass. Energy not transferred is used or released as heat, while carbon atoms remain in organisms, waste, or environmental reservoirs.

Accept equivalent fraction, decimal, or percent calculations. For conservation explanations, accept statements that carbon atoms move to other organisms, waste, soil, water, or air rather than disappearing.