Biology · Ecology · Worked solutions

Energy flow in ecosystems

1. Identify the producer in algae → water flea → small fish and explain your choice.

Algae are producers because they make organic material using light energy.

2. Place a caterpillar, a leaf and a bird in a food chain. Explain the direction of the arrows.

Leaf → caterpillar → bird. Arrows show the direction in which energy passes through food.

3. In grass → rabbit → fox, identify the secondary consumer and explain your answer.

The fox is the secondary consumer because it eats the primary consumer, the rabbit.

4. Give two reasons why energy transferred to one consumer level is below the energy stored at the previous level.

Some food is not eaten or assimilated, and organisms transfer energy to the surroundings through respiration.

5. A plant population stores 8,000 kJ, and its grazers store 800 kJ. Calculate energy transfer efficiency.

(800 ÷ 8000) × 100 = 10%.

Worked solutions · Questions 6–10

6. Explain how fungi can return mineral nutrients from dead leaves to soil.

Fungi decompose organic material. Mineral nutrients are released into the surroundings and can become available for uptake by plants.

7. An insect-eating bird eats beetles and caterpillars. Explain why a food web represents this relationship better than a single chain.

A food web shows multiple food sources or pathways for energy transfer. A single chain shows only one pathway.

8. Producers store 40,000 kJ. Transfer efficiencies to the next two consumer levels are 20% and 10%. Find the energy stored at the second consumer level.

First level: 40,000 × 0.20 = 8,000 kJ. Second level: 8,000 × 0.10 = 800 kJ.

9. In a pond, fish eat insect larvae, and the larvae eat algae. Predict one possible effect of a sharp drop in predator fish and explain why it is uncertain.

Larvae may increase because predation decreases. Other factors, such as alternative predators or food limits, could change the outcome.

10. Explain why a pyramid of numbers can be inverted in a woodland but a pyramid of energy for that chain is not.

One large tree can support many small consumers, so counts can be inverted. Less usable energy is transferred at each feeding link, so energy decreases up the chain.