

Energy Transfer in Living Organisms

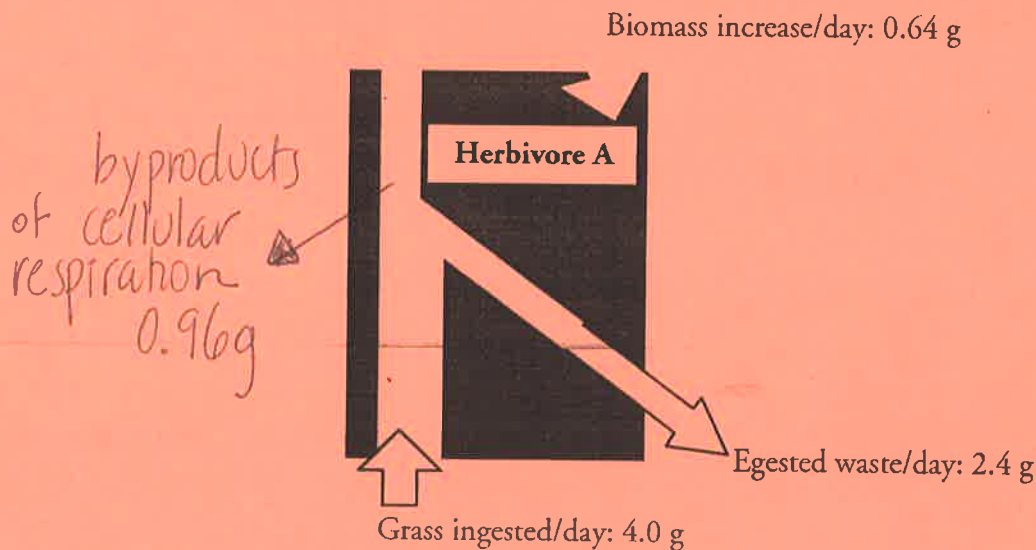
How does energy move through an organism?

Why?

The **law of conservation of energy** states that energy can be neither created nor destroyed; it can only be transferred to another form. In living things energy is transferred as organic matter (molecules of carbohydrate, fats, starch, etc.). But does an organism use all of the energy that is provided by the organic matter available? How is the law of conservation of energy applied to living organisms?

changed or transformed

Model 1 – Food Conversion in a Herbivore



1. According to Model 1, how many grams of grass does herbivore A eat each day?

4.0g/day

2. Refer to Model 1.

- a. How much did herbivore A grow from eating this grass?

0.64g/day

- b. What term is used to represent growth in Model 1?

biomass increase

3. What is meant by "egested waste" as it is used in Model 1?

undigested food or fecal material

4. Is all of the mass of the ingested grass accounted for in the growth and waste of herbivore A? If not, how much is "missing"? Show a mathematical calculation to support your answer.

$$4.0g - (0.64g + 2.4g) = 0.96g \text{ unaccounted}$$



5. In addition to growth and waste production, what else does herbivore A's body do with the food it ingests?

fuel for body processes (cellular respiration)
herbivore converts energy stored in grass sugar ^{to use} by cells

6. As cells undergo cellular respiration, what products are produced, and how are they released from the body?

waste products of cellular respiration = $CO_2 + \text{Water}$
exhaled or excreted

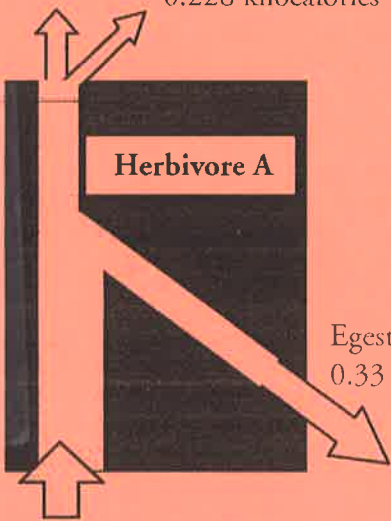
7. Draw an arrow in Model 1 to represent respiration and label it with the appropriate title and mass.



Model 2 – Energy Efficiency in Two Organisms

Respiration/day: 0.192 kilocalories

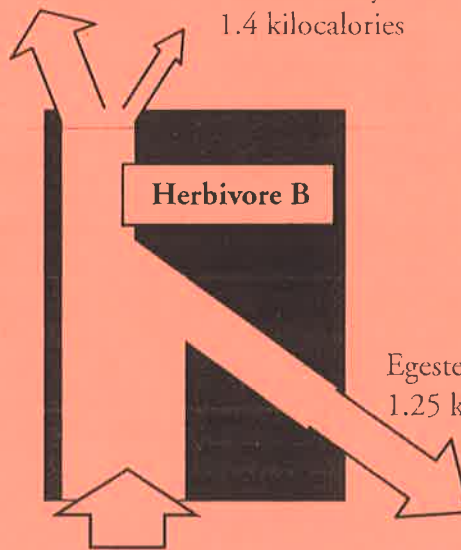
Heat loss/day:
0.228 kilocalories



Grass ingested/day: 0.8 kilocalories

Respiration/day: 1.6 kilocalories

Heat loss/day:
1.4 kilocalories



Grass ingested/day: 5 kilocalories

8. What unit of energy is used in Model 2?

Kilocalories

9. Refer to the energy value of the ingested grass in Model 2.

a. What is the energy value of the grass eaten by herbivore A each day?

0.8 Kcal

b. What is the energy value of the grass eaten by herbivore B each day?

5 Kcal

c. Which herbivore would you predict to be the larger animal? Explain.

Herbivore B → has to have more energy to fuel body