

Trophic levels and ecological pyramids: practice questions

7 questions • 25 marks • mark scheme at the back

For Cambridge IGCSE Biology 0610 (and 0970, which has the same content). **Supplement** is Extended content, only examined on Papers 2 and 4.

Name

Total / 25

- 1** In the food chain algae → water flea → minnow → heron, at which trophic level is the heron? [1 mark]
- A. ☐ Trophic level 2
- B. ☐ Trophic level 3
- C. ☐ Trophic level 4
- D. ☐ Trophic level 5
- 2** A pyramid of numbers for a woodland food chain has the following values: 1 oak tree, 800 caterpillars, 30 blue tits. (a) Describe the shape of the pyramid of numbers. [2] (b) Explain why a pyramid of biomass would be a better way to represent this food chain. [2]

- 3** The table shows the biomass at each trophic level in a grassland. (a) State the name given to the frog in this food chain. [1] (b) Draw a pyramid of biomass using the data and a scale of 1 cm = 50 g per m². [2] **[3 marks]**

Biomass in a grassland		
Trophic level	Organism	Biomass / g per m ²
1	Grass	500
2	Grasshopper	100
3	Frog	20

- 4** **Supplement** **[3 marks]**
- The table shows the energy flowing through each trophic level in an ecosystem. (a) Describe how a pyramid of energy for this data would be drawn. [2] (b) State one advantage of a pyramid of energy over a pyramid of numbers. [1]

Energy flow in an ecosystem	
Trophic level	Energy / kJ per m ² per year
Producers	8 000
Primary consumers	900
Secondary consumers	80

Primary consumers in a field receive 900 kJ of energy per m² per year from the producers. The secondary consumers gain 108 kJ per m² per year. Calculate the efficiency of energy transfer from the primary to the secondary consumers. Give your answer as a percentage and show your working.

Answer =

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(a) Explain why the transfer of energy from one trophic level to the next is often not efficient. [4] (b) Explain, in terms of energy loss, why food chains usually have fewer than five trophic levels. [3]

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A farmer can grow wheat to feed to people, or grow the same wheat to feed to cattle that are eaten by people. Explain why it is more energy efficient for humans to eat the wheat than to eat the cattle.

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Mark scheme

One mark for each point unless a maximum is given. Words in brackets are not needed for the mark.

1. [1]

C C (1)

2. [4]

- (a) the producer / oak tree bar is very short / shorter than the caterpillar bar (1)
- (a) the caterpillar bar is the longest, with a shorter blue tit bar above it (1) allow not pyramid-shaped / inverted
- (b) numbers ignore the size of the organisms / one tree is very large (1)
- (b) a pyramid of biomass takes size into account and is usually pyramid-shaped (1)

3. [3]

- (a) secondary consumer (1) allow carnivore
- (b) bars drawn to scale: 10 cm, 2 cm and 0.4 cm (1)
- (b) grass at the bottom, bars centred and each labelled (1)

4. [3] **Supplement**

- (a) a bar for each trophic level with the producers at the bottom (1)
- (a) length of each bar drawn to scale / proportional to the energy value (1)
- (b) always pyramid-shaped / takes size of organisms into account / shows rate of energy flow (1)

5. [3] **Supplement**

- $\text{efficiency} = \text{energy transferred} \div \text{energy available} \times 100$ (1)
- $= 108 \div 900 \times 100$ (1)
- $= 12\%$ (1) correct answer with no working gains 3 marks

6. [7] **Supplement**

- (a) not all of the organism is eaten / parts such as bones or roots are not eaten (1)
- (a) some of the food eaten is not digested / is lost as faeces (1)
- (a) energy is lost in excretion / in urine (1)
- (a) energy is released by respiration / used for movement and keeping warm and lost as heat to the environment (1)
- (b) energy is lost at each trophic level / transfer is not efficient (1)
- (b) so less energy is available at each higher level (1)
- (b) there is too little energy left to support another trophic level / population (1)

7. [4] **Supplement**

- eating the wheat has fewer trophic levels / fewer steps in the food chain (1)
- energy is lost at each trophic level / transfer (1)
- cattle lose energy by respiration / movement / heat / keeping warm (1)
- cattle lose energy in faeces and urine, so less is stored in the meat (1)
- more people can be fed from the same area of land (1)
- Max 4