

# Organisms and their environment practice questions

26 questions • 83 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 ..... / 83

## Energy flow, food chains and food webs Spec 19.1, 19.2.1-19.2.10

- 1** What is the principal source of energy input to biological systems? [1 mark]
- A. ☐ Chemical energy in glucose
  - B. ☐ Heat from the soil
  - C. ☐ Light energy from the Sun
  - D. ☐ Energy released by decomposers
- 2** In a food chain, what do the arrows show? [1 mark]
- A. ☐ The direction in which animals move
  - B. ☐ The transfer of energy from one organism to the next
  - C. ☐ The number of organisms at each level
  - D. ☐ The organisms that are harmful to others
- 3** Describe the flow of energy through living organisms, starting with light energy from the Sun. [3 marks]

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- 4** A food chain is: lettuce → snail → thrush → sparrowhawk (a) State the producer in this food chain. [1] (b) State the organism that is the secondary consumer. [1] (c) Name the organism that gets its energy directly from the thrush. [1] (d) State what the arrow between the lettuce and the snail represents. [1] **[4 marks]**

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- 5** The table shows what each organism in a woodland food web eats. (a) State the number of different organisms that eat caterpillars. [1] (b) Name one organism that is both a primary consumer and a secondary consumer. [1] (c) Define the term food web. [1] (d) Suggest what happens to the number of owls if all the blue tits are killed by disease. [1] **[4 marks]**

| Feeding relationships in a woodland food web |                         |
|----------------------------------------------|-------------------------|
| Organism                                     | Eats                    |
| Oak leaves                                   | (producer)              |
| Caterpillar                                  | Oak leaves              |
| Mouse                                        | Oak leaves, caterpillar |
| Blue tit                                     | Caterpillar             |
| Owl                                          | Mouse, blue tit         |

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- 6** Which organism gets its energy from dead or waste organic material? **[1 mark]**

- A. ☐ A producer  
B. ☐ A herbivore  
C. ☐ A decomposer  
D. ☐ A secondary consumer

- 7** Fishing boats catch large numbers of a fish that is eaten by seals and that eats small crustaceans. (a) State the term for catching a species faster than it can replace itself. [1] (b) Describe the effect of this on the seal population and explain your answer. [2] (c) Describe two ways in which introducing a foreign species to a habitat can affect the food web. [2] **[5 marks]**

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## Trophic levels and ecological pyramids Spec 19.2.11-19.2.19

- 8** 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

- 9** 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] **[4 marks]**

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- 10** 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 m<sup>2</sup>. [2] **[3 marks]**

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

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- 11** **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 <sup>2</sup> per year |
| Producers                   | 8 000                                   |
| Primary consumers           | 900                                     |
| Secondary consumers         | 80                                      |

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Primary consumers in a field receive 900 kJ of energy per m<sup>2</sup> per year from the producers. The secondary consumers gain 108 kJ per m<sup>2</sup> 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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## Nutrient cycles Spec 19.3

**15** Which process removes carbon dioxide from the air? [1 mark]

- A. ☐ Respiration
- B. ☐ Combustion
- C. ☐ Photosynthesis
- D. ☐ Decomposition

**16** Describe how carbon in the bodies of dead plants returns to the air as carbon dioxide, [4 marks]  
and how carbon in dead organisms that are buried for millions of years may later return to the air.

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**17** A student states that the amount of carbon dioxide in the air stays roughly constant in a [3 marks]  
natural ecosystem. (a) Name the process that removes carbon dioxide from the air. [1] (b)  
Name two processes that add carbon dioxide to the air. [2]

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**18** Supplement [1 mark]

Which process changes nitrate ions in the soil into nitrogen gas?

- A. ☐ Nitrification
- B. ☐ Denitrification
- C. ☐ Nitrogen fixation
- D. ☐ Deamination

Describe the roles of microorganisms in the nitrogen cycle by stating what each of the following does. (a) decomposers [1] (b) nitrifying bacteria [1] (c) nitrogen-fixing bacteria [1] (d) denitrifying bacteria [1]

Explain how nitrogen in the air becomes part of the protein in a cow that eats grass.

Populations

Spec 19.4

- A. ☐ All the organisms in an ecosystem
- B. ☐ A group of organisms of one species, living in the same area, at the same time
- C. ☐ All the species in a habitat
- D. ☐ A group of different species living together

A woodland contains oak trees, foxes, rabbits, fungi and soil, light and water. (a) State what is meant by the term community. [1] (b) State what is meant by the term ecosystem. [1] (c) Name one population in the woodland. [1]

**23** State four factors that affect the rate of population growth of an organism.

**[4 marks]**

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**24** A small number of bacteria were added to a flask of nutrient broth. The number of bacteria was counted every 2 hours. (a) Name the phase of growth between 4 and 6 hours. [1] (b) Name the phase of growth between 8 and 12 hours. [1] (c) Describe what happens to the number of bacteria between 12 and 14 hours. [1] (d) Calculate the increase in the number of bacteria between 2 and 6 hours. [1]

**[4 marks]**

| Number of bacteria in the flask |                                                   |
|---------------------------------|---------------------------------------------------|
| time / hours                    | number of bacteria / millions per cm <sup>3</sup> |
| 0                               | 2                                                 |
| 2                               | 3                                                 |
| 4                               | 12                                                |
| 6                               | 60                                                |
| 8                               | 100                                               |
| 10                              | 100                                               |
| 12                              | 100                                               |
| 14                              | 40                                                |

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Supplement

[4 marks]

Explain why the number of bacteria in the flask in the previous question became constant between 8 and 12 hours.

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Supplement

[5 marks]

Explain why a population of yeast cells grows slowly at first, then very quickly, in a closed container with a limited supply of sugar.

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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. [1]

B B (1)

3. [3]

- light energy is transferred to chemical energy in producers / plants by photosynthesis (1)
- chemical energy passes to consumers / along the food chain when organisms feed (1)
- energy is eventually transferred to the environment / lost as heat (1) allow lost through respiration

4. [4]

- (a) lettuce (1)
- (b) thrush (1)
- (c) sparrowhawk (1)
- (d) transfer of energy (from the lettuce to the snail) (1) ignore 'the snail eats the lettuce' on its own

5. [4]

- (a) 2 / mouse and blue tit (1)
- (b) mouse (1)
- (c) a network of interconnected food chains (1)
- (d) owls decrease because there is less food (1) allow owls stay about the same because they eat more mice instead; ignore 'owls stay the same' without a reason

6. [1]

C C (1)

7. [5]

- (a) overharvesting / overfishing (1)
- (b) seal population decreases / seals die or move away (1)
- (b) because there is less food (fish) for them to eat (1)
- (c) the foreign species may eat native species so their numbers fall (1)
- (c) the foreign species may compete with native species for food so their numbers fall (1) allow it becomes a new food source so its predators increase

8. [1]

C C (1)

9. [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)

**10. [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)

**11. [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)

**12. [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

**13. [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)

**14. [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

**15. [1]**

**C C** (1)

**16. [4]**

- decomposers / bacteria and fungi break down the dead plants (1)
- decomposers respire (1)
- releasing carbon dioxide (into the air) (1)
- buried organisms form fossil fuels / coal, oil, gas (1)
- burning / combustion of the fossil fuel releases carbon dioxide (1)
- Max 4

**17. [3]**

- (a) photosynthesis (1)
- (b) any two from: respiration; combustion / burning; decomposition / decay (2)
- ignore breathing

**18. [1] Supplement**

**B B (1)**

**19. [4] Supplement**

- (a) break down proteins in dead material / waste to ammonium ions (1) allow ammonia
- (b) change ammonium ions into nitrate ions (1) allow via nitrite ions
- (c) change nitrogen gas into nitrogen compounds (1) allow ammonium ions / nitrates
- (d) change nitrate ions into nitrogen gas (1)

**20. [5] Supplement**

- nitrogen fixation / nitrogen gas is changed into nitrogen compounds (1)
- by lightning or by nitrogen-fixing bacteria (1)
- nitrifying bacteria change ammonium ions to nitrate ions (1)
- grass absorbs nitrate ions through its roots (1)
- grass makes amino acids and then proteins (1)
- cow eats / feeds on the grass (1)
- cow digests the protein to amino acids and uses them to make its own protein (1)
- Max 5

**21. [1]**

**B B (1)**

**22. [3]**

- (a) all of the populations of different species in an ecosystem (1)
- (b) a unit containing the community of organisms and their environment, interacting together (1)
- (c) all the foxes / all the rabbits / all the oak trees (1) reject an answer naming more than one species

**23. [4]**

- food supply (1)
- competition (1)
- predation (1)
- disease (1)

**24. [4]**

- (a) exponential / log (phase) (1)
- (b) stationary (phase) (1)
- (c) falls / decreases (from 100 to 40 million per  $\text{cm}^3$ ) (1)
- (d)  $60 - 3 = 57$  million per  $\text{cm}^3$  (1) allow 57 000 000 per  $\text{cm}^3$

**25. [4] Supplement**

- (nutrients / food become) limiting factor(s) (1)
- nutrients / food running out / lack of space / toxic waste products build up (1)
- more competition (for nutrients) (1)
- rate of reproduction / birth rate equals death rate (1)
- so there is no overall change in numbers (1)
- Max 4

**26. [5] Supplement**

- at the start there are few cells to reproduce / cells adjusting (1)
- so the birth rate is low and growth is slow (lag phase) (1)
- sugar and space are plentiful, so there is little competition (1)
- cells reproduce faster than they die, and each new cell can reproduce (1)
- so numbers increase rapidly (exponential phase) (1)
- limiting factors are not yet acting (1)
- Max 5