

Ecology and the environment practice questions

27 questions · 88 marks · mark scheme at the back

For Pearson Edexcel International GCSE Biology 4BI1 and Science (Double Award) 4SD0. **Biology only** is not in the Double Award and is only examined on Paper 2.

Name

Total / 88

The organism in the environment Spec 4.1–4.5

- 1** All the organisms of different species living together in a wood form which of the following? [1 mark]
- A. ☐ A population
- B. ☐ A community
- C. ☐ A habitat
- D. ☐ An ecosystem
- 2** A pond contains frogs, fish, water plants and water. State the ecological term for each of the following. (a) All the frogs in the pond. (b) The place where the frogs live. (c) The frogs, fish and plants together with the water, light and temperature of the pond. [3 marks]

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- 3** A field has an area of 400 m². A student used a 0.25 m² quadrat to count buttercups at six random positions. The results are shown in the table. Estimate the number of buttercups in the field. [3 marks]

Buttercups counted in each quadrat						
Quadrat	1	2	3	4	5	6
Number of buttercups	4	7	5	6	3	5

Answer =

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- 4** A student wants to compare the population size of daisies in a shaded part of a lawn and in a sunny part of the same lawn, using quadrats. Describe how the student should do this. **[4 marks]**

- 5** **Biology only** **[2 marks]**
State what is meant by the term biodiversity.

- 6** **Biology only** **[4 marks]**
A student investigated the distribution of a plant species from a shaded woodland edge out into a sunny field, and also measured the biodiversity of the field. Describe how the student could do this using quadrats.

13 Explain why only about 10% of the energy in one trophic level is transferred to the next trophic level. **[4 marks]**

[illegible]

14 A food chain is: grass → grasshopper → frog → snake. Describe how energy and substances pass along this food chain, and explain why there is much less biomass at the snake level than at the grass level. **[6 marks]**

[illegible]

Cycles within ecosystems Spec 4.10–4.11B

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

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

16 Dead leaves fall to the ground and are broken down. Describe how the carbon in the leaves is returned to the atmosphere. **[3 marks]**

[illegible]

17 Describe how carbon dioxide is removed from the atmosphere and how it is returned to the atmosphere in the carbon cycle. **[4 marks]**

18 **Biology only** **[1 mark]**

Which bacteria convert ammonium ions in the soil into nitrates?

- A. ☐ Nitrifying bacteria
- B. ☐ Denitrifying bacteria
- C. ☐ Nitrogen-fixing bacteria
- D. ☐ Decomposers

19 **Biology only** **[2 marks]**

Denitrifying bacteria are active in waterlogged soil. Explain how this affects the growth of crops.

20 **Biology only** **[6 marks]**

Describe the roles of bacteria in the nitrogen cycle and explain how nitrogen in the air becomes part of the protein in a cow.

Spec 4.12-4.18B

[1 mark]

- A. ☐ It dissolves in blood plasma and makes it acidic
- B. ☐ It combines with haemoglobin so less oxygen is carried
- C. ☐ It destroys white blood cells
- D. ☐ It blocks the alveoli with mucus

[3 marks]

[illegible]

[4 marks]

[illegible]

[4 marks]

[illegible]

[3 marks]

[illegible]

26

[6 marks]

Explain how the fertiliser could have caused the death of the fish.

[illegible]

27

Biology only

[4 marks]

Explain how deforestation can lead to soil erosion and to an increase in the concentration of carbon dioxide in the atmosphere.

[illegible]

Mark scheme

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

1. [1]

B B (1)

2. [3]

- population (1)
- habitat (1)
- ecosystem (1)

3. [3]

- mean = $(4 + 7 + 5 + 6 + 3 + 5) \div 6 = 5$ per quadrat (1)
- number of quadrat areas in the field = $400 \div 0.25 = 1600$ (1)
- estimated population = $5 \times 1600 = 8000$ (buttercups) (1)
- award 3 marks for the correct answer with no working; allow error carried forward from an incorrect mean

4. [4]

- place quadrats at random / use random coordinates from a random number generator (1)
- count the number of daisies inside each quadrat (1)
- use the same size of quadrat and the same number of quadrats in each area, with many quadrats (1)
- calculate the mean number of daisies per quadrat for each area and compare (1)

5. [2] **Biology only**

- the variety / number of different species (1)
- in a habitat / ecosystem / on Earth (1)
- do not accept: the number of organisms

6. [4] **Biology only**

- lay a tape measure / transect line across the habitat from the shade into the field (1)
- place a quadrat at regular intervals along the line and count the plants of the species in each (1)
- for biodiversity, place quadrats randomly in the field (1)
- count the number of different species in each quadrat and calculate the mean number of species (1)
- allow measuring light intensity at each position with a light meter

7. [6]

Level 3 5-6	A detailed, well-structured answer that describes and explains the effect of at least two abiotic factors and at least two biotic factors, linking each to population size or distribution, with correct scientific terms.
Level 2 3-4	Describes the effect of both abiotic and biotic factors, with some explanation. The links to population size or distribution may be incomplete.
Level 1 1-2	Names one or more factors, with a limited or no explanation of their effect.

Indicative content

- abiotic: light (less light means fewer plants can photosynthesise, so fewer plants and fewer animals that depend on them; shade-tolerant plants found where light is low)
- abiotic: temperature (affects enzyme-controlled reactions, so growth and survival; species only survive within a range)
- abiotic: water (organisms need water; fewer survive in dry areas, those adapted to dry conditions found there)
- biotic: competition for light, water, mineral ions, food, space (better-adapted species survive and reproduce more, so the other species decrease)
- biotic: predation (predator numbers rise when prey numbers rise; prey numbers then fall; predator peak follows prey peak)

8. [1]

D D (1)

9. [3]

- break down dead plants and animals / waste (1)
- by secreting enzymes (onto the material) (1)
- small soluble molecules diffuse into the decomposer / mineral ions or nutrients are returned to the soil for plants to take up (1)

10. [4]

- (a) a food chain in the correct order, e.g. grass → rabbit → buzzard (1)
- arrows pointing from the food to the organism that eats it (1)
- (b) fox / buzzard / owl (1)
- (c) rabbit numbers fall because the foxes / predators eat more rabbits (1)
- allow for (c): rabbit numbers rise because there is less competition for grass

11. [3]

- a pyramid of number only counts the organisms and ignores their size (1)
- there is one (very large) oak tree supporting many caterpillars, so the bottom bar is the narrowest (1)
- a pyramid of biomass shows the mass of living material, and the oak tree has the greatest mass (1)

12. [2]

- $1200 \div 15\,000 \times 100$ (1)
- 8 (%) (1)
- award 2 marks for the correct answer with no working

13. [4]

- not all of the organism is eaten, for example bones / roots (1)
- some of what is eaten is not digested and is lost as faeces (1)
- energy is released by respiration and lost as heat to the surroundings (1)
- energy is used for movement / keeping warm (1)
- energy is lost in waste such as urine (1)
- Max 4

14. [6]

Level 3 5-6	A detailed, well-structured answer that describes the transfer of both energy and substances along the chain by feeding, and explains at least three ways energy or biomass is lost, linking this to the decrease in biomass at higher levels.
Level 2 3-4	Describes transfer along the chain and gives at least two ways energy or biomass is lost, with a partial link to the decrease in biomass.
Level 1 1-2	States that energy passes along the chain or that energy is lost, with little or no explanation.

Indicative content

- grass absorbs light energy and uses it in photosynthesis to make biomass; this stores energy
- energy and substances (carbon compounds) pass to each organism when it eats the one before
- only about 10% of energy is transferred at each step
- losses: parts not eaten (bones, roots); not digested and lost in faeces
- losses: respiration releases energy as heat; energy used for movement and keeping warm; waste such as urine
- so less energy and biomass is available at each higher trophic level, and the snake level has the least

15. [1]

B B: photosynthesis uses carbon dioxide to make glucose (1)

16. [3]

- decomposers / bacteria and fungi break down the leaves (1)
- decomposers respire (1)
- releasing carbon dioxide (into the air) (1)
- allow CO₂

17. [4]

- plants / algae take in carbon dioxide (1)
- for photosynthesis (1)
- respiration (by plants, animals and decomposers) returns carbon dioxide (1)
- combustion of fuels / burning releases carbon dioxide (1)
- decomposition / decay releases carbon dioxide (1)
- Max 4

18. [1] Biology only

A A: nitrifying bacteria carry out nitrification (1)

19. [2] Biology only

- denitrifying bacteria convert nitrates into nitrogen gas (1)
- so there are fewer nitrates for the plants to absorb / less protein made so poorer growth (1)

20. [6] Biology only

Level 3 5-6	A clear, logical and complete account that covers decomposers, nitrification, nitrogen fixation and denitrification, and links these to uptake of nitrates by plants and feeding by the cow.
Level 2 3-4	Describes at least three of the bacterial processes with some correct links, but the route from air nitrogen to cow protein is incomplete.
Level 1 1-2	Gives one or two isolated points about bacteria, with little or no link to plants or the cow.

Indicative content

- nitrogen-fixing bacteria (in soil or root nodules) convert nitrogen gas into nitrogen compounds / nitrates
- plants absorb nitrates through their roots
- plants use nitrates to make amino acids and proteins
- cow eats plants and digests the protein to amino acids, which it uses to make its own protein
- dead plants, dead animals and waste (urea) broken down by decomposers, releasing ammonia / ammonium ions
- nitrifying bacteria convert ammonium ions into nitrates
- denitrifying bacteria convert nitrates to nitrogen gas, returning it to the air

21. [1]

B B: carbon monoxide binds to haemoglobin, reducing oxygen transport (1)

22. [3]

- sulfur dioxide is released (1)
- it dissolves in rain water to form acid rain (1)
- acid rain lowers the pH of the lake so fish cannot survive (1)
- allow acidic / acidity for acid

23. [4]

- first gas named: methane / nitrous oxide / CFCs / water vapour (1)
- a human activity that matches the first gas (1)
- second gas named (1)
- a human activity that matches the second gas (1)
- activities: methane – cattle / rice paddy fields / landfill; nitrous oxide – (nitrogen) fertilisers / vehicle exhausts; CFCs – old refrigerators / aerosols / air conditioners; water vapour – burning fuels
- reject carbon dioxide; the activity must match the gas named; ignore 'pollution' or 'factories' alone

24. [4]

- the Earth's surface gives out infrared radiation (1)
- greenhouse gases / carbon dioxide absorb infrared radiation (1)
- and radiate it back towards the Earth (1)
- more carbon dioxide means more heat is trapped, so the average temperature rises (1)
- allow heat for infrared radiation; reject answers based on the ozone layer

25. [3]

- sewage contains organic matter / is food for decomposers, so decomposers / bacteria increase (1)
- they use up oxygen in respiration (1)
- fish die from lack of oxygen (1)
- ignore 'sewage poisons the fish'

26. [6]

Level 3 5-6	A clear, logical and complete sequence from leaching of minerals to the death of fish, including algal bloom, loss of light, death of plants, increase in decomposers and loss of oxygen.
Level 2 3-4	A sequence with most stages, but with one or two missing or unclear links, for example no mention of decomposers or of light being blocked.
Level 1 1-2	One or two correct but isolated points, such as that fertiliser makes algae grow, without explaining how fish are affected.

Indicative content

- heavy rain leaches nitrates / minerals from the fertiliser into the lake
- extra nitrates cause rapid growth of algae (algal bloom) on the surface
- the algae block light from plants lower down
- plants cannot photosynthesise and die
- decomposers / bacteria feed on the dead plants and algae and increase in number
- decomposers use up oxygen in aerobic respiration
- low oxygen concentration so fish die / suffocate
- biodiversity falls

27. [4] **Biology only**

- tree roots held the soil together; with no trees, soil is washed / blown away (1)
- so topsoil is lost / soil erosion (1)
- fewer trees so less photosynthesis, less carbon dioxide removed from the air (1)
- burning / decay of the felled trees releases carbon dioxide (1)