K5E Ecosystems and Interdependence: Depth and Practice

AQA AQA KS3 Biology · Calculator allowed · about 80 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 State two biotic factors in a pond ecosystem.

(1)

2 Give two examples of abiotic factors that could affect plant growth in a meadow.

(2)

3 A hedgerow contains blackbirds, worms, nettles and foxes. Complete the food chain below by writing the missing organism names.
Nettles -> _____ -> _____ -> Foxes

(3)

4 Describe how removing a top predator, such as foxes, from an area could change the numbers of plants and small animals in that ecosystem.

(4)

5 Priya measures the number of dandelions in two square metre plots in a grassland. Plot A has 14 dandelions, Plot B has 6 dandelions. Calculate the mean number of dandelions per square metre for these two plots.

(3)

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6 Kwame sets up a simple pond microhabitat in a tray to study decomposition. He adds dead leaves, water and pond mud. Which two abiotic and two biotic variables should he keep the same between three trays to make the investigation fair?

(4)

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7 Name the process by which plants use light to make their own food.

(1)

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8 A simple food web for a pond is given by these relationships:
Algae eaten by water fleas and snails.
Water fleas eaten by small fish.
Snails eaten by herons.
Small fish eaten by herons and otters.
Draw two different food chains from this web, each starting with algae and ending with a top predator.

(4)

9 Explain how competition between two plant species for light could change the plant community over several seasons.

(3)

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10 A student samples two areas of woodland and counts the number of bluebell plants in five 1 m^2 quadrats in each area. Area 1 counts: 8, 10, 9, 7, 6. Area 2 counts: 4, 5, 6, 5, 4. Calculate the mean number of bluebells per square metre for Area 1 and Area 2, and say which area has the higher mean.

(3)

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11 Name two ways energy is lost from a food chain as it moves from one trophic level to the next.

(2)

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12 Give one example of a decomposer and describe its role in an ecosystem in one sentence.

(2)

13 A conservation group measures the population of a rare butterfly over three years. Their counts are 120, 96 and 77. Calculate the percentage change in population from year 1 to year 3. Give your answer to one decimal place.

(4)

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14 A student suggests that adding extra bird feeders to a garden will increase fox numbers because birds are food for foxes. Give two reasons why this prediction might not be correct.

(3)

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15 Describe how you would use quadrats to estimate the percentage cover of grass in a field. Include how to choose locations and how to make the estimate.

(3)

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16 In a small river, pollution reduces oxygen levels. Explain two likely effects this change will have on the river community and why.

(4)

17 A student wants to investigate how light intensity affects the number of pond snails seen at the surface. She sets up three identical aquaria with the same number of snails and pondweed, and measures the number of snails at the surface after 30 minutes for each light level. Name one variable she must control and explain why, and suggest one improvement to make the results more reliable.

(3)

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18 Extended response: Evaluate the statement 'Reintroducing a single missing species into an ecosystem will always restore the original balance of that ecosystem.' In your answer consider food webs, competition, unintended consequences and uncertainty. Use evidence and reasoning to support your judgement.

(6)

Mark scheme · K5E Ecosystems and Interdependence: Depth and Practice

Question 1

- **B1** any one biotic factor, e.g. algae, insects, fish, plants, bacteria (cao)
- Answer: **e.g. algae or insects (either is acceptable as one biotic factor).**

Question 2

- **B1** first valid abiotic factor, e.g. sunlight, soil pH, temperature, water, mineral levels, wind
- **B1** second valid abiotic factor (different to first)
- Answer: **e.g. sunlight and soil pH**

Question 3

- **M1** second trophic level: an herbivore that eats nettles, e.g. caterpillar, snail or rabbit
- **M1** third trophic level: a small predator or omnivore that eats that herbivore, e.g. blackbird, thrush or small mammal
- **A1** ordering nettles -> herbivore -> predator -> foxes, oe
- Answer: **Example: Nettles -> caterpillar -> blackbird -> foxes**

Question 4

- **M1** identifies that removal of foxes reduces predation on their prey (small predators or herbivores)
- **M1** states that the prey population will increase as a result
- **M1** links increased prey numbers to greater grazing or predation on plants or smaller animals
- **A1** gives the likely consequence: decrease in some plant species or reduced numbers of the smaller animals that get eaten by the now more abundant prey, with causal link
- Answer: **Without foxes small predator or herbivore numbers rise, leading to more plant eating and a decrease in plant numbers or declines in some small animal populations.**

Question 5

- **M1** calculate total dandelions = 14 + 6 = 20
- **A1** mean = 20 / 2 = 10 cao
- **B1** state unit: dandelions per square metre or per m^2
- Answer: **10 dandelions per square metre**

Question 6

- **M1** one abiotic variable named, e.g. temperature, light level, water volume, pH
- **M1** second abiotic variable named different from first, e.g. temperature and water volume
- **M1** one biotic variable named, e.g. same type and mass of leaves, same source of pond mud
- **A1** second biotic variable named and explanation that keeping them the same makes a fair test, oe
- Answer: **e.g. Abiotic: temperature and water volume. Biotic: same type and mass of leaves, same source of pond mud (to keep microbes similar).**

Question 7

- **B1** photosynthesis cao
- Answer: **Photosynthesis**

Question 8

- **M1** first correct chain algae -> water flea -> small fish -> heron or otter
- **M1** second correct chain algae -> snail -> heron or other top predator different from first chain
- **M1** both chains start with algae and end with a top predator
- **A1** chains correctly written with arrows and valid organisms, oe
- Answer: **Examples: 1) Algae -> water flea -> small fish -> heron. 2) Algae -> snail -> heron.**

Question 9

- **M1** states that taller or faster-growing species will capture more light
- **M1** explains that the shaded species will have reduced photosynthesis and lower growth or reproduction
- **A1** concludes that over seasons the shaded species may decline in number while the dominant species increases, with causal link
- Answer: **The taller species gets more light and so has higher photosynthesis; the shaded species has less energy for growth and reproduction and may decline over time, causing the dominant species to become more common.**

Question 10

- **M1** correct total and division for Area 1: (8+10+9+7+6)=40, mean = 40/5
- **A1** Area 1 mean = 8.0 cao
- **A1** Area 2 mean = (4+5+6+5+4)=24, mean = 24/5 = 4.8 and Area 1 has the higher mean
- Answer: **Area 1 mean = 8.0 per m^2; Area 2 mean = 4.8 per m^2. Area 1 has the higher mean.**

Question 11

- **B1** respiration (energy used for movement, heat)
- **B1** energy lost in waste or uneaten parts, e.g. bones, faeces
- Answer: **Respiration (heat loss) and energy lost in waste/uneaten parts.**

Question 12

- **B1** example of a decomposer, e.g. fungi, bacteria, earthworm
- **B1** role described: breaks down dead material and returns nutrients to the soil
- Answer: **e.g. Earthworms: they break down dead plant material and help return nutrients to the soil.**

Question 13

- **M1** calculate change = 77 - 120 = -43
- **M1** percentage change = (change / original) x 100 = (-43 / 120) x 100
- **A1** percentage = -35.833...%
- **A1** answer rounded to one decimal place = -35.8% (or decrease of 35.8%) cao
- Answer: **Decrease of 35.8%**

Question 14

- **M1** reason 1: foxes eat many things and may not rely mainly on birds
- **M1** reason 2: increased bird feeders might not increase available birds if predators catch them or if disease reduces bird numbers
- **A1** consequence or extra factor given, e.g. habitat or human disturbance limits fox increase, oe
- Answer: **Birds are not the only food for foxes, and extra feeders may not raise the bird population due to predation or disease; other factors such as shelter limit fox numbers.**

Question 15

- **M1** method: place a 1 m^2 quadrat at several randomly chosen or systematically spaced locations
- **M1** count or visually estimate the percentage cover of grass in each quadrat
- **A1** calculate an average percentage cover from the quadrat results and state that random sampling reduces bias
- Answer: **Randomly place a 1 m^2 quadrat at many locations, estimate percentage grass cover in each, then average the percentages to give the field estimate.**

Question 16

- **M1** effect 1 identified: organisms requiring high oxygen, such as insect larvae and trout, will decrease
- **M1** reason for effect 1: low oxygen reduces respiration and survival
- **M1** effect 2 identified: decomposer bacteria may increase if organic pollution increases, causing further oxygen drop or change in species
- **A1** linking statement about changes in food web or community structure as a result, oe
- Answer: **Low oxygen causes sensitive species like insect larvae and trout to decline because they cannot respire effectively, and increased decomposer activity on extra organic matter can lower oxygen further, changing the community structure.**

Question 17

- **B1** one controlled variable named, e.g. same water temperature, same number of snails, same pondweed, same water volume
- **M1** explains why controlling this variable is important, e.g. temperature affects snail activity so must be constant
- **A1** suggests an improvement to reliability, e.g. repeat the measurements several times and use the mean, or increase number of aquaria per light level
- Answer: **Control example: keep water temperature the same because temperature affects snail activity. Improvement: repeat the experiment several times and average the results to improve reliability.**

Question 18

- **Level 3** (5-6): Detailed evaluation with a clear judgement. Explains multiple consequences of reintroducing a species, including effects on food webs, competition and possible unintended consequences, and uses evidence or reasoning to support why restoration may or may not occur.
- **Level 2** (3-4): Some evaluation with partial reasoning. Describes likely effects on food webs and competition and gives at least one reason why reintroduction might not restore balance.
- **Level 1** (1-2): Simple or descriptive points only. Limited reasoning or a basic statement for or against the idea without supporting detail.
- **Indicative content:**
  - Reintroducing a species can help restore missing trophic links and reduce overabundant prey, improving ecosystem function.
  - Food webs are complex so adding one species could have ripple effects, including changes in competition, disease transmission or predation on non-target species.
  - Competition from established species may prevent the reintroduced species from establishing, or the habitat conditions that allowed the original species to thrive may no longer exist.
  - Unintended consequences include introduced species becoming invasive, spreading parasites, or causing decline of other native species.
  - Uncertainty in outcomes due to environmental change, human impacts and limited data; need for monitoring, pilot studies and adaptive management.
  - A balanced judgement should note that reintroduction can be valuable but is not guaranteed to restore original balance without wider habitat and community management.