1.5 Ecosystems and Interdependence: 1-hour Pack

Calculator allowed · about 60 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A food web in a pond includes: algae, water fleas, small fish, big fish, and herons. Draw or describe a food web that includes all five organisms and explain how energy flows through it.

(a) Describe a food web including arrows that show who eats whom. **(2)**

(b) Explain how energy flows through the food web. **(2)**

2 An ecologist samples beetles along a transect in a woodland and records the following numbers in five equal-area squares placed along the transect: 3, 5, 2, 7, 4.
Calculate the median number of beetles per square and suggest one reason why the numbers might vary along the transect.

(a) Calculate the median of the counts 3, 5, 2, 7, 4. **(2)**

(b) Suggest one reason for variation in beetle numbers along the transect. **(1)**

3 Name one way plants are adapted to reduce competition with other plants for light.

(a) Give one plant adaptation to reduce competition for light and briefly say how it helps. **(2)**

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4 State two biotic factors in a pond ecosystem.

(1)

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5 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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6 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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7 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)

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

(2)

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9 A hedgerow contains blackbirds, caterpillars, nettles and foxes. Complete the food chain below by writing the missing organism names.

Nettles -> _____ -> _____ -> Foxes

(3)

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10 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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11 Explain how competition between two plant species for light could change the plant community over several seasons.

(3)

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12 Ecologists use precise scientific vocabulary to describe ecosystems.

(a) Define the term 'habitat'. **(1)**

(b) Define the term 'population'. **(1)**

(c) Define the term 'community'. **(1)**

(d) Define the term 'ecosystem'. **(1)**

(e) Define the term 'niche'. **(1)**

13 Every ecosystem is shaped by biotic (living) factors and abiotic (non-living) factors. Classify each of the following factors as biotic or abiotic.

(a) Rainfall. **(1)**

(b) Presence of parasites. **(1)**

(c) Oxygen concentration dissolved in pond water. **(1)**

(d) Competition for nesting sites. **(1)**

(e) Soil pH. **(1)**

(f) Availability of prey. **(1)**

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14 In a farmland ecosystem, wheat is eaten by field mice, which are in turn eaten by barn owls.

(a) Construct a food chain for wheat, field mice and barn owls, using arrows to show the direction of energy transfer. **(1)**

(b) Identify the producer, the primary consumer and the secondary consumer in this food chain. **(3)**

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15 A freshwater pond food web contains the following feeding relationships, where an arrow points from the organism eaten to the organism that eats it: pondweed -> tadpole -> perch -> pike -> heron; algae -> water flea -> stickleback -> heron.

(a) Identify the two producers in this food web. **(1)**

(b) Name a predator of the water flea. **(1)**

(c) Explain why the heron can be described as occupying two different trophic levels in this food web. **(1)**

(d) If the tadpole population in this pond were wiped out by a disease, name one organism whose population would most directly lose a food source. **(1)**

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Mark scheme · 1.5 Ecosystems and Interdependence: 1-hour Pack

Question 1

(a) correct links showing algae -> water fleas -> small fish -> big fish -> heron and also algae -> small fish directly or water fleas -> big fish, showing a web — **M1**

(a) use of arrows or text indicating direction of energy flow (eg algae eaten by water fleas), oe — **A1**

(a) Answer: **Example: algae -> water fleas -> small fish -> big fish -> heron, and algae -> small fish and water fleas -> big fish, showing several feeding links.**

(b) energy enters via producers (algae) using sunlight — **M1**

(b) energy passes to consumers when they eat other organisms and is lost at each step as heat, so less energy at higher trophic levels, oe — **A1**

(b) Answer: **Energy enters the web when algae use sunlight; consumers gain energy by eating other organisms and energy is lost from the system at each step, so less energy reaches the heron than the small fish.**

Question 2

(a) order the numbers and pick the middle value (2,3,4,5,7) — **M1**

(a) 4 cao — **A1**

(a) Answer: **4 beetles per square**

(b) one plausible reason eg changes in vegetation, shade, moisture, presence of predators, human disturbance, microhabitat differences, oe — **B1**

(b) Answer: **Variation may be due to changes in vegetation or moisture along the transect.**

Question 3

(a) adaptation named and brief correct explanation eg tall growth/long stems to reach light or large leaves to capture more light or climbing habit to reach above neighbours — **M1**

(a) linked effect eg more light captured so better photosynthesis, oe — **A1**

(a) Answer: **Example: growing tall stems so the plant reaches above neighbours and gets more light for photosynthesis.**

Question 4

any one biotic factor, e.g. algae, insects, fish, plants, bacteria (cao) — **B1**

Answer: **e.g. algae or insects (either is acceptable as one biotic factor).**

Question 5

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 — **M1**

consequence or extra factor given, e.g. habitat or human disturbance limits fox increase, oe — **A1**

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 6

one controlled variable named, e.g. same water temperature, same number of snails, same pondweed, same water volume — **B1**

explains why controlling this variable is important, e.g. temperature affects snail activity so must be constant — **M1**

suggests an improvement to reliability, e.g. repeat the measurements several times and use the mean, or increase number of aquaria per light level — **A1**

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 7

Level 3 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. — **5-6**

Level 2 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. — **3-4**

Level 1 Simple or descriptive points only. Limited reasoning or a basic statement for or against the idea without supporting detail. — **1-2**

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.

Question 8

first valid abiotic factor, e.g. sunlight, soil pH, temperature, water, mineral levels, wind — **B1**

second valid abiotic factor (different to first) — **B1**

Answer: **e.g. sunlight and soil pH**

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Question 9

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 — **M1**

ordering nettles -> herbivore -> predator -> foxes, oe — **A1**

Answer: **Example: Nettles -> caterpillar -> blackbird -> foxes**

Question 10

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 — **M1**

second biotic variable named and explanation that keeping them the same makes a fair test, oe — **A1**

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 11

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 — **M1**

concludes that over seasons the shaded species may decline in number while the dominant species increases, with causal link — **A1**

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 12

(a) the place where an organism normally lives oe — **B1**

(a) Answer: **The place where an organism normally lives.**

(b) all the organisms of one species living in the same habitat at the same time oe — **B1**

(b) Answer: **All the organisms of one species living in the same habitat at the same time.**

(c) all the populations of different species living and interacting in the same habitat oe — **B1**

(c) Answer: **All the populations of different species living and interacting together in the same habitat.**

(d) a community of organisms together with the non-living (abiotic) conditions in the area, and the way they all interact oe — **B1**

(d) Answer: **A community of organisms together with the non-living (abiotic) conditions in that area, and the way they all interact.**

(e) the specific role and position of an organism within its habitat, including what it eats, where it lives and how it interacts with other organisms oe — **B1**

(e) Answer: **The specific role and position of an organism within its habitat, including what it eats and how it interacts with other species.**

Question 13

(a) abiotic cao — **B1**

(a) Answer: **Abiotic.**

(b) biotic cao — **B1**

(b) Answer: **Biotic.**

(c) abiotic cao — **B1**

(c) Answer: **Abiotic.**

(d) biotic cao — **B1**

(d) Answer: **Biotic.**

(e) abiotic cao — **B1**

(e) Answer: **Abiotic.**

(f) biotic cao — **B1**

(f) Answer: **Biotic.**

Question 14

(a) wheat -> field mouse -> barn owl, with arrows pointing from organism eaten to organism that eats it — **B1**

(a) Answer: **wheat -> field mouse -> barn owl**

(b) producer = wheat — **B1**

(b) primary consumer = field mouse — **B1**

(b) secondary consumer = barn owl — **B1**

(b) Answer: **Producer: wheat. Primary consumer: field mouse. Secondary consumer: barn owl.**

Question 15

(a) pondweed and algae, both required — **B1**

(a) Answer: **Pondweed and algae.**

(b) stickleback cao — **B1**

(b) Answer: **Stickleback.**

(c) in the pondweed chain the heron eats pike (a tertiary consumer), so it is a quaternary consumer (trophic level 5), but in the algae chain it eats stickleback (a secondary consumer), so it is a tertiary consumer (trophic level 4); the two chains have different lengths so the heron occupies two different trophic levels oe; accept: the number of steps from the producer to the heron is different in the two chains — **B1**

(c) Answer: **In the pondweed chain the heron eats pike, so it is a quaternary consumer (trophic level 5); in the algae chain it eats stickleback, so it is a tertiary consumer (trophic level 4). The chains have different lengths, so the heron occupies two different trophic levels.**

(d) perch cao — **B1**

(d) Answer: **Perch.**

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