1.7 Ecology: Test Pack

AQA 8461 · Calculator allowed · about 55 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 An oak tree, insects and birds are found in a park. The oak tree produces leaves which provide food for the insects. Some birds eat the insects.

(a) Give the name for an organism that makes its own food by photosynthesis. **(1)**

(b) Give the name for an organism that eats other animals. **(1)**

(Total for Question 1 is 2 marks)

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2 Which of the following is an abiotic factor in an ecosystem? Choose one: temperature, bacteria, rabbit, fungus.

- ☐ temperature
- ☐ bacteria
- ☐ rabbit
- ☐ fungus

(Total for Question 2 is 1 mark)

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3 Living things can be organised into different levels within an ecosystem.

(a) Complete the sequence of levels of organisation, from smallest to largest: organism, _____, community, ecosystem. **(1)**

(b) Explain the difference between a population and a community. **(2)**

(Total for Question 3 is 3 marks)

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4 A river has a population of mayfly larvae. A pollution event reduces oxygen levels and many larvae die. State two biotic or abiotic factors that could explain why some larvae survived while others died.

(a) Give one abiotic factor that could have helped some larvae survive the pollution and explain why it would help. **(2)**

(b) Give one biotic factor that could have helped some larvae survive, and explain why. **(2)**

(Total for Question 4 is 4 marks)

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5 A student measured the light intensity and counted the number of bluebell plants growing at five points along a line from the edge of a wood to the middle of the wood. Her results are shown below.

Point 1 (wood edge): light intensity 82 units, 3 bluebells
Point 2: light intensity 61 units, 9 bluebells
Point 3: light intensity 40 units, 18 bluebells
Point 4: light intensity 22 units, 27 bluebells
Point 5 (wood middle): light intensity 9 units, 34 bluebells

Point	Wood position	Light intensity (units)	Bluebells
1	wood edge	82	3
2		61	9
3		40	18
4		22	27
5	wood middle	9	34

(a) Identify the abiotic factor that the student investigated. **(1)**

(b) Describe the relationship shown by the student's results. **(2)**

(c) Suggest a reason for the relationship you described in part (b). **(2)**

(Total for Question 5 is 5 marks)

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6 Look at the simplified energy transfer: grass (1000 units) -> rabbit -> fox. Only 10% of energy is transferred at each step.

(a) Calculate the energy available to the rabbit. **(1)**

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(b) Calculate the energy available to the fox. **(1)**

.....

(c) State one implication of only 10% transfer for the number of top predators an area can support. **(1)**

(Total for Question 6 is 3 marks)

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7 The table shows the population of a moth species and the average winter temperature over ten years in the same woodland.

Year 1: winter temp 2 C, moth population 1200
Year 3: winter temp 4 C, moth population 1650
Year 5: winter temp 1 C, moth population 950
Year 7: winter temp 6 C, moth population 2100
Year 9: winter temp 3 C, moth population 1400

(a) Describe the trend shown between winter temperature and the moth population. **(2)**

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(b) Suggest a reason, linked to this abiotic factor, for the change in the moth population. **(2)**

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(Total for Question 7 is 4 marks)

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8 A gamekeeper recorded the estimated numbers of foxes and rabbits on an estate over six years.

Year 1: rabbits 420, foxes 18
Year 2: rabbits 610, foxes 22
Year 3: rabbits 780, foxes 35
Year 4: rabbits 540, foxes 48
Year 5: rabbits 310, foxes 30
Year 6: rabbits 260, foxes 19

(a) Describe the pattern shown by the fox population compared with the rabbit population over the six years. **(2)**

(b) Explain why the change in the fox population lags behind the change in the rabbit population. **(3)**

(Total for Question 8 is 5 marks)

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9 A food web in a hedgerow contains the following feeding relationships: grass is eaten by both rabbits and voles; rabbits are eaten by foxes and owls; voles are eaten by owls only.

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

(b) Name one secondary consumer in this food web. **(1)**

(c) Construct one complete food chain from this food web that includes the owl. **(2)**

(d) A disease sharply reduces the rabbit population. Predict the effect on the owl population, giving a reason. **(2)**

(Total for Question 9 is 6 marks)

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10 In a closed aquatic microcosm experiment to measure respiration, Erin measures dissolved oxygen at the start and after 24 hours in the dark. Initial DO = 9.2 mg L^{-1}, final DO = 6.8 mg L^{-1}. The volume of water is 2.0 L. Calculate the rate of oxygen consumption in mg per L per hour, and the total oxygen used in the whole microcosm per hour (in mg h^{-1}). Show substitutions.

(a) Calculate the rate of oxygen consumption in mg per L per hour. Show substitution. **(2)**

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(b) Calculate the total oxygen used in the whole 2.0 L microcosm per hour (mg h^{-1}). Show substitution. **(2)**

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(Total for Question 10 is 4 marks)

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11 Ecological succession can change species composition over time. Describe primary succession on a bare rock surface and explain two processes that make the environment suitable for later species.

(a) Describe primary succession on bare rock and explain two processes that improve conditions for later species. **(4)**

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(Total for Question 11 is 4 marks)

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Mark scheme · 1.7 Ecology: Test Pack

Question 1

(a) producer (accept green plant or autotroph) **B1**

(a) Answer: Producer

(b) consumer (accept carnivore or predator) **B1**

(b) Answer: Consumer

Question 2

temperature cao **B1**

Answer: temperature

Question 3

(a) population **B1**

(a) Answer: Population.

(b) a population is all the organisms of one species in an area (oe) **B1**

(b) a community is all the populations of different species in an area (oe) **B1**

(b) Answer: A population is all the organisms of a single species in an area, whereas a community is all the different populations (of different species) living together in that area.

Question 4

(a) identifies an abiotic factor and links it to survival (e.g. higher oxygen pockets, faster flow, cooler temperature) **M1**

(a) explanation: such a factor gives more oxygen or reduces toxic concentration so larvae survive, oe **A1**

(a) Answer: Any abiotic factor linked to survival, for example: patches of water with higher oxygen due to faster flow, so larvae in those patches had more oxygen and survived.

(b) identifies a biotic factor and links it to survival (e.g. presence of tolerant species, food availability, fewer predators) **M1**

(b) explanation: this factor increases chance of survival for some larvae (e.g. tolerant species reduce competition or predators were fewer), oe **A1**

(b) Answer: Any biotic factor linked to survival, for example: areas with more food meant larvae could develop faster and were less affected by pollution.

Question 5

(a) light intensity **B1**

(a) Answer: Light intensity.

(b) as light intensity decreases (from the wood edge to the middle), the number of bluebells increases (oe) **B1**

(b) correct use of at least two data points/values to support the trend (e.g. 82 units/3 bluebells compared with 9 units/34 bluebells) **B1**

(b) Answer: As light intensity decreases from the wood edge to the middle of the wood, the number of bluebell plants increases: there are 3 bluebells at 82 units at the wood edge, compared with 34 bluebells at 9 units in the wood middle.

(c) bluebells are adapted to grow in low light, so they can grow in the shadier middle of the wood (oe) **B1**

(c) fewer competing plants can grow well in the shade, so bluebells may face less competition for resources there than at the brighter wood edge (oe) **B1**

(c) Answer: Bluebells are adapted to grow well in shadier conditions and face less competition from other plants (e.g. grasses) in the middle of the wood, whereas the brighter wood edge favours other species that out-compete bluebells there.

Question 6

(a) calculates 10% of 1000 = 100 units **B1**

(a) Answer: 100 units

(b) calculates 10% of 100 = 10 units **B1**

(b) Answer: 10 units

(c) there will be fewer top predators because little energy is available at higher trophic levels, oe **B1**

(c) Answer: Fewer top predators because little energy is available at higher trophic levels.

Question 7

(a) as average winter temperature increases, the moth population increases (a positive correlation) (oe) **B1**

(a) correct use of data, e.g. the lowest temperature (1 C, year 5) matches the lowest population (950), and the highest temperature (6 C, year 7) matches the highest population (2100) **B1**

(a) Answer: The moth population rises as the average winter temperature rises: the coldest winter (1 C) has the smallest population (950) and the mildest winter (6 C) has the largest population (2100).

(b) milder winters mean more moths (or their eggs/pupae) survive the winter, e.g. fewer die from cold stress or from a lack of energy reserves (oe) **B1**

(b) more survivors in spring means more moths are available to reproduce, increasing the population further (oe, allow reference to food availability) **B1**

(b) Answer: Milder winters allow more moths, eggs or pupae to survive the cold, so more individuals are left to reproduce in spring, leading to a larger population overall.

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Question 8

(a) the fox population rises and falls in the same general pattern as the rabbit population (oe) **B1**

(a) the change in fox numbers lags behind (happens slightly after) the change in rabbit numbers, e.g. rabbits peak in year 3 but foxes peak in year 4 **B1**

(a) Answer: The fox population follows the same rise-and-fall pattern as the rabbit population, but the change in fox numbers lags about a year behind the change in rabbit numbers.

(b) foxes are predators of rabbits (their prey), so when rabbit numbers rise there is more food available for foxes (oe) **B1**

(b) this greater food supply means more foxes survive and reproduce successfully, so the fox population increases, but only after the rabbit population has already increased **B1**

(b) as the fox population rises, predation increases and reduces the rabbit population; the falling rabbit numbers then leave less food for foxes, so the fox population later falls too (oe) **B1**

(b) Answer: Foxes rely on rabbits for food, so a rise in rabbit numbers only leads to a rise in fox numbers once the extra food has allowed more foxes to survive and breed; the resulting increase in predation then reduces rabbit numbers, causing fox numbers to fall shortly afterwards, so predator numbers always change slightly after prey numbers.

Question 9

(a) grass **B1**

(a) Answer: Grass.

(b) fox or owl (either accepted) **B1**

(b) Answer: The fox (or the owl).

(c) correct three organisms in the chain, e.g. grass -> vole -> owl or grass -> rabbit -> owl **B1**

(c) arrows correctly drawn/described in the direction of energy transfer (from grass to consumer to owl) **B1**

(c) Answer: grass -> vole -> owl (or grass -> rabbit -> owl).

(d) a plausible prediction for the owl population: it may decrease, or may remain fairly stable if voles provide enough alternative food (oe) **B1**

(d) a reason linked to the prediction: fewer rabbits mean less food, reducing owl survival or reproduction; or owls can eat voles instead if enough are available (oe). Do not require a prediction about the vole population. **B1**

(d) Answer: The owl population may decrease because fewer rabbits mean less food, reducing owl survival or reproduction. It may remain fairly stable if enough voles are available as alternative prey, but their abundance is not given.

Question 10

(a) substitutes: rate per L per hour = (9.2 - 6.8) / 24 **M1**

(a) 0.10 mg L^{-1} h^{-1} cao **A1**

(a) Answer: 0.10 mg L^{-1} h^{-1}

(b) multiplies rate per L by volume: 0.10 x 2.0 **M1**

(b) 0.20 mg h^{-1} cao **A1**

(b) Answer: 0.20 mg h^{-1}

Question 11

(a) describes early colonisers such as lichens and mosses colonising bare rock and starting soil formation, oe **M1**

(a) explains that weathering and acid produced by lichens break down rock to form small particles, producing initial soil, oe **A1**

(a) explains that accumulation of dead organic matter from colonisers increases soil depth and nutrients, allowing larger plants to establish, oe **A1**

(a) states that these changes in soil and moisture lead to succession towards more complex plant communities, oe **A1**

(a) Answer: Primary succession begins with pioneer species like lichens and mosses that colonise bare rock. They produce acids and trap particles that weather the rock into small soil particles, and their dead organic matter accumulates to increase soil depth and nutrients, allowing grasses and then shrubs and trees to establish.

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