1.7 Ecology: 1-hour Pack

AQA 8461 · Calculator allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Carbon is constantly cycled between living organisms, the atmosphere and the environment. Describe how carbon dioxide is removed from the atmosphere and returned to it in the carbon cycle. Your answer should refer to photosynthesis, respiration and combustion.

(Total for Question 1 is 4 marks)

2 A large area of tropical rainforest is cleared each year to plant palm oil trees.

(a) Give one reason why rainforest land is cleared for palm oil plantations. **(1)**

(b) Explain two negative effects of large-scale deforestation like this on the environment. **(4)**

(Total for Question 2 is 5 marks)

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3 Required practical: a student used a 0.25 m^2 quadrat to sample the number of daisy plants growing in a field with a total area of 400 m^2. She placed the quadrat 8 times and recorded these counts of daisies: 3, 5, 4, 6, 2, 5, 7, 4.

(a) Calculate the mean number of daisies per quadrat. **(2)**

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(b) Use your answer to part (a) to calculate an estimate of the total number of daisies in the whole field. **(3)**

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(c) Describe how the student should position her quadrats to make sure her sampling is not biased. **(2)**

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(Total for Question 3 is 7 marks)

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4 A student investigates how light affects the growth of seedlings. She grows seedlings in three trays: Tray 1 in full light, Tray 2 in dim light, Tray 3 in darkness. After two weeks the mean shoot lengths are: Tray 1 = 10 cm, Tray 2 = 6 cm, Tray 3 = 2 cm. The student concludes that more light increases shoot growth. Explain and evaluate the student's conclusion.

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(Total for Question 4 is 6 marks)

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5 A ten-year survey of a forest ecosystem recorded snowshoe hare (prey) and Canada lynx (predator) numbers every two years. Year: 0, 2, 4, 6, 8, 10. Hares (thousands): 20, 60, 80, 40, 20, 50. Lynx (thousands): 4, 5, 8, 10, 6, 4. Use the data to calculate the percentage change in the hare population between year 4 and year 6, state the relationship shown between the two population trends, then calculate the percentage change in the lynx population between year 6 and year 8 and explain and predict what happens next in the cycle.

(a) Calculate the percentage change in the hare population between year 4 and year 6. Show substitution. **(2)**

(b) State the relationship shown between the hare and lynx population trends across the survey. **(1)**

(c) Calculate the percentage change in the lynx population between year 6 and year 8. Show substitution. Then explain why lynx numbers fall after hare numbers have already started to fall, and predict what is likely to happen to the hare population by year 10 as a result. **(4)**

(Total for Question 5 is 7 marks)

6 Priya studies two plant species on a coastal sand dune. One species has long roots and waxy leaves; the other has shallow fibrous roots and large thin leaves.

(a) Explain how long roots and waxy leaves help the first plant survive the sand dune environment. **(3)**

(Total for Question 6 is 3 marks)

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7 A pond food chain measured by biomass is: algae 500 g m^{-2} -> small invertebrates 120 g m^{-2} -> small fish 24 g m^{-2}. Calculate the percentage efficiency of biomass transfer from algae to small invertebrates, and from small invertebrates to small fish.

(a) Calculate percentage efficiency of biomass transfer from algae to small invertebrates. Show substitution. **(2)**

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(b) Calculate percentage efficiency of biomass transfer from small invertebrates to small fish. Show substitution. **(1)**

.....

(Total for Question 7 is 3 marks)

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8 Lichens are used as indicator species for air pollution (sulfur dioxide). A survey recorded which type of lichen was found at increasing distances from a factory.
0 m from factory: no lichen present
100 m from factory: only crusty lichen present
500 m from factory: crusty and leafy lichen present
1000 m from factory: crusty, leafy and bushy lichen present (bushy lichen is the most sensitive to pollution)

(a) State what is meant by an 'indicator species'. **(1)**

(b) Describe how the range of lichen species changes with distance from the factory. **(2)**

(c) Explain what this data suggests about air quality near the factory. **(2)**

(Total for Question 8 is 5 marks)

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9 A student ran a belt transect from the edge of a footpath into an open field to see how moss cover changed with distance. She recorded the percentage cover of moss in a quadrat every 2 metres.
Distance from path: 0 m, 2 m, 4 m, 6 m, 8 m, 10 m
Percentage cover of moss: 80%, 60%, 40%, 20%, 10%, 5%

(a) Describe the trend shown by the transect data. **(2)**

(b) Suggest an abiotic factor that could explain this trend, and explain your reasoning. **(3)**

(Total for Question 9 is 5 marks)

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Mark scheme · 1.7 Ecology: 1-hour Pack

Question 1

carbon dioxide is removed from the atmosphere by green plants and algae during photosynthesis, which converts it into carbon compounds/biomass (oe) **B1**

carbon is passed along food chains as organisms eat other organisms/plants **B1**

carbon dioxide is returned to the atmosphere through respiration, carried out by plants and animals (and other organisms) **B1**

carbon dioxide is also returned to the atmosphere by combustion (burning) of wood or fossil fuels formed from the remains of dead organisms (oe) **B1**

Answer: Carbon dioxide is taken from the atmosphere by photosynthesis in plants and algae, which converts it into carbon compounds passed along food chains; it is returned to the atmosphere through the respiration of living organisms and through the combustion of wood and fossil fuels.

Question 2

(a) to grow palm oil for use in food, cosmetics or biofuel (or to make money/for the economic benefit of the crop) (oe) **B1**

(a) Answer: Palm oil is a valuable crop used in food, cosmetics and biofuel, so clearing the land to grow it generates income.

(b) loss of habitat for the species that lived in the rainforest (named effect 1) **B1**

(b) this reduces biodiversity, as species may become endangered or extinct if they cannot survive elsewhere (linked explanation) **B1**

(b) less carbon dioxide is removed from the atmosphere by photosynthesis (fewer trees), and burning/decaying cleared trees releases stored carbon dioxide (named effect 2) **B1**

(b) this contributes to an increase in atmospheric carbon dioxide levels, adding to the greenhouse effect/global warming (linked explanation) **B1**

(b) Answer: Deforestation destroys the habitat of rainforest species, reducing biodiversity as some species cannot survive elsewhere; it also removes trees that would otherwise take in carbon dioxide by photosynthesis, and burning or decaying the cleared trees releases stored carbon dioxide, adding to the greenhouse effect.

Question 3

(a) total = 36 (sum of the 8 counts), divided by 8 **M1**

(a) 4.5 (daisies per quadrat) cao **A1**

(a) Answer: 4.5 daisies per quadrat.

(b) density = mean per quadrat / quadrat area, e.g. 4.5 / 0.25 (= 18 daisies per m^2) **M1**

(b) 18 x 400 (total field area) **M1**

(b) 7200 daisies, allow ecf from part (a) **A1**

(b) Answer: Approximately 7200 daisies.

(c) lay out two tape measures at right angles (or mark out a grid) across the field to create a set of coordinates **B1**

(c) use a random number generator/table to pick coordinates and place the quadrat at each randomly generated point, repeating for all 8 quadrats (oe: prevents the student choosing areas that look like they have more/fewer daisies) **B1**

(c) Answer: Lay two tape measures at right angles across the field to form a grid of coordinates, then use a random number generator to pick coordinate pairs and place the quadrat at each randomly chosen point, so the sampling positions are not chosen by the student and are not biased.

Question 4

Level 3 Detailed explanation with clear judgement and reference to data and experimental factors. **5-6**

Level 2 Some explanation with reference to the data and at least one evaluation point. **3-4**

Level 1 Simple statements about the pattern in the data with little or no evaluation. **1-2**

Indicative content:

- Describe the pattern in the data: mean lengths 10, 6, 2 cm showing greater light gives greater growth.
- Explain biologically: light provides energy for photosynthesis so seedlings in more light produce more sugars for growth.
- Consider alternative explanations or limitations: other factors not controlled (temperature, water, nutrients), seeds may vary in vigour, small sample sizes.
- Evaluate the conclusion: data supports that more light increases shoot growth but only if other variables were controlled; suggest repeating with controls or measuring more replicates.
- Suggest improvements: use same seed batch, control water and temperature, increase number of seedlings per tray.

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Question 5

(a) substitutes: ((40 - 80) / 80) x 100 **M1**

(a) 50% decrease cao **A1**

(a) Answer: 50% decrease

(b) the lynx (predator) population rises and falls in the same pattern as the hare (prey) population but lags behind it by about two years, oe **B1**

(b) Answer: The lynx population follows the same rise-and-fall pattern as the hare population, but lags roughly two years behind it: hares peak at year 4 and lynx peak at year 6.

(c) substitutes: ((6 - 10) / 10) x 100 **M1**

(c) 40% decrease cao **A1**

(c) explains that fewer hares means less food available for lynx, so lynx face more competition and their survival and reproduction fall, reducing the lynx population (with a time lag before the effect shows), oe **M1**

(c) predicts that with fewer lynx there is less predation pressure, so the hare population is likely to recover/increase again by year 10, oe **A1**

(c) Answer: 40% decrease. Lynx numbers fall because there is less prey available once hare numbers have dropped, so lynx compete more for food and fewer survive to reproduce. With fewer lynx, predation pressure on hares falls, so the hare population is likely to rise again, consistent with the year 10 hare count of 50 thousand.

Question 6

(a) identifies water shortage or unstable sand as an abiotic stress and links long roots to accessing deeper water or stabilising the plant, oe **M1**

(a) states that waxy leaves reduce water loss by transpiration, reducing evaporation from the leaf surface, cao **A1**

(a) links these adaptations to increased survival in the dry, sandy environment, oe **A1**

(a) Answer: Long roots reach deeper water and help stabilise the plant in shifting sand; waxy leaves reduce water loss by transpiration, so the plant conserves water in the dry, exposed dune environment.

Question 7

(a) substitutes: efficiency = (120 / 500) x 100 **M1**

(a) 24% cao **A1**

(a) Answer: 24%

(b) 20% (24 / 120 x 100) **B1**

(b) Answer: 20%

Question 8

(a) a species whose presence, absence or abundance shows the level of pollution (or another environmental condition) in an area (oe) **B1**

(a) Answer: A species whose presence or absence indicates the level of pollution (or another environmental condition) in a habitat.

(b) the number/range of lichen species present increases with distance from the factory **B1**

(b) correct reference to the data, e.g. no lichen at all at 0 m, but all three types (including the most sensitive, bushy lichen) present by 1000 m **B1**

(b) Answer: The range of lichen species increases with distance from the factory: no lichen grows right next to it, but by 1000 m away all three types, including the most pollution-sensitive bushy lichen, are present.

(c) air quality is likely to be poor/more polluted (with sulfur dioxide) close to the factory, and improves further away **B1**

(c) because only the most pollution-tolerant lichen (crusty) can survive close to the factory, whereas the most pollution-sensitive lichen (bushy) can only survive where sulfur dioxide levels are low, i.e. far from the factory **B1**

(c) Answer: Air quality is likely to be worse (more sulfur dioxide) close to the factory, since only the most pollution-tolerant lichen can survive there, while the most sensitive species only grows further away, where pollution levels are lower.

Question 9

(a) percentage cover of moss decreases with increasing distance from the footpath (oe) **B1**

(a) correct use of at least two data values to support the trend, e.g. 80% at 0 m falling to 5% at 10 m **B1**

(a) Answer: The percentage cover of moss decreases steadily as the distance from the footpath increases, from 80% at the path edge to just 5% at 10 m.

(b) moisture/water availability (e.g. the soil near the footpath may be more compacted and retain more surface water, or be shadier and damper) (oe, allow light intensity with suitable linked reasoning) **B1**

(b) moss needs a constantly moist surface to grow well/to reproduce, so areas with more moisture support more moss growth **B1**

(b) further from the path the ground may be drier/more exposed, so conditions are less suitable for moss and cover decreases **B1**

(b) Answer: Moisture is likely to explain the trend: the compacted, shadier ground near the footpath probably stays damper, and moss needs a constantly moist surface to grow and reproduce, so cover is high there; further into the field the ground is likely drier and less suitable for moss, so cover falls.

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