B7bD Biodiversity, Cycles and Human Impact: Exam Drill

AQA 8464 · Calculator allowed · about 95 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 This question checks three key terms used in this topic.

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

(b) Define the term 'greenhouse gas'. **(1)**

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

(Total for Question 1 is 3 marks)

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2 An area of mangrove forest covered 1800 hectares in 2010. By 2025, clearance for shrimp farming had reduced the area of mangrove forest to 1260 hectares. (1 hectare = 0.01 km^2, i.e. 100 hectares = 1 km^2.)

(a) Calculate the percentage decrease in the area of mangrove forest between 2010 and 2025. **(3)**

.....

(b) Convert the remaining mangrove forest area in 2025 (1260 hectares) into km^2. **(2)**

.....

(Total for Question 2 is 5 marks)

3 Carbon is constantly cycled between the atmosphere, living organisms and fossil fuels. Two processes that return carbon to the atmosphere, as carbon dioxide, are combustion and decomposition.

(a) Explain how combustion returns carbon to the atmosphere as carbon dioxide. **(2)**

(b) Explain how decomposition returns carbon to the atmosphere as carbon dioxide. **(2)**

(Total for Question 3 is 4 marks)

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4 Required practical: Oliwia investigates the effect of temperature on the rate of decomposition of milk. She mixes milk, lipase solution and sodium carbonate solution containing phenolphthalein indicator (pink in alkaline conditions) in a test tube at each of five temperatures, and times how long it takes for the mixture to turn from pink to colourless as fatty acids are produced. Her results are shown below.

10 degrees C: 260 s
20 degrees C: 150 s
30 degrees C: 70 s
40 degrees C: 45 s
50 degrees C: 130 s

(a) Identify the optimum temperature for lipase activity shown by this data, and explain how the data shows this. **(2)**

(b) Explain, in terms of enzyme structure, why the rate of reaction decreased between 40 degrees C and 50 degrees C. **(3)**

(Total for Question 4 is 5 marks)

5 Kwame surveys the number of individual invertebrates of each species living in two ponds, Pond A and Pond B. Each pond has 4 species present and 110 individuals in total.
Pond A: species counts of 30, 28, 26 and 26
Pond B: species counts of 92, 6, 5 and 7

(a) Calculate the percentage of individuals in Pond B that belong to the most common species. **(2)**

.....

(b) State the species richness (the number of different species present) in Pond A and in Pond B. **(1)**

(c) Using your answers to (a) and (b), explain why Pond A has greater biodiversity than Pond B, even though both ponds have the same species richness and the same total number of individuals. **(2)**

(Total for Question 5 is 5 marks)

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6 Fertiliser is accidentally spilled into a stream. A week later, an ecologist finds many dead fish in the stream, but the dead fish are concentrated in a stretch of the stream about 500 m downstream of the spill, rather than at the spill site itself.

(a) Explain the sequence of events, starting with the fertiliser entering the stream, that leads to the death of fish some distance downstream. **(4)**

(Total for Question 6 is 4 marks)

7 A wildlife charity asks volunteers across the country to count the number of different butterfly species they see in their own garden over one hour, once a year, and submit the results online. The charity uses the average number of species reported each year as a measure of change in butterfly biodiversity over time.

(a) Suggest one reason why this method might not give a reliable measure of the change in butterfly biodiversity from year to year. **(2)**

(b) Suggest one change to the method that would improve the reliability of year-to-year comparisons. **(1)**

(Total for Question 7 is 3 marks)

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8 A local council is choosing between two schemes to increase biodiversity in a river valley: (1) planting a new area of native broadleaf woodland on unused farmland, or (2) creating a wetland reserve by allowing a low-lying field to flood seasonally. Evaluate the two schemes and recommend which the council should choose.

(Total for Question 8 is 6 marks)

9 A conservation charity estimated the UK hedgehog population at 1 600 000 in 2005. Because of habitat loss and fragmentation, the estimated population had fallen to 560 000 by 2025.

(a) Calculate the percentage decrease in the estimated hedgehog population between 2005 and 2025. **(3)**

.....

(b) Higher tier only. New roads and housing estates have divided much of the hedgehogs' remaining habitat into small, isolated patches. Explain how this fragmentation can reduce the hedgehog population, beyond simply reducing the total area of habitat available. **(2)**

(Total for Question 9 is 5 marks)

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10 A car emits 132 g of carbon dioxide for every km it is driven.

(a) Calculate the mass of carbon dioxide, in kg, produced during a 250 km journey. **(3)**

.....

(b) Suggest one way the driver could reduce the total carbon dioxide emissions of this journey, other than driving a shorter distance. **(1)**

(Total for Question 10 is 4 marks)

11 The table shows the mean atmospheric carbon dioxide concentration, in parts per million (ppm), recorded at a monitoring station in four different years.

1990: 354 ppm
2000: 369 ppm
2010: 389 ppm
2020: 414 ppm

(a) Calculate the mean rate of increase in carbon dioxide concentration, in ppm per year, between 1990 and 2020. **(3)**

.....

(b) Assuming the concentration continues to increase at this same mean rate, predict the carbon dioxide concentration in 2030. **(1)**

(Total for Question 11 is 4 marks)

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Question 1

- (a) **B1** the variety of different species (of organisms) that live in an area (or on Earth), oe
- **(a) Answer: The variety of different species living in an area (or on Earth).**
- (b) **B1** a gas in the atmosphere that absorbs and re-radiates heat energy from the Sun/Earth, keeping the atmosphere warmer than it would otherwise be, oe
- **(b) Answer: A gas in the atmosphere that absorbs and re-radiates heat energy, warming the atmosphere.**
- (c) **B1** able to be broken down by microorganisms (decomposers), oe
- **(c) Answer: Able to be broken down by microorganisms.**

Question 2

- (a) **M1** calculates the decrease: 1800 - 1260 = 540 hectares
- (a) **M1** substitutes: (540 / 1800) x 100
- (a) **A1** 30% cao
- **(a) Answer: 30% decrease**
- (b) **M1** uses the conversion 100 hectares = 1 km^2
- (b) **A1** 12.6 km^2 cao
- **(b) Answer: 12.6 km^2**

Question 3

- (a) **M1** combustion is the burning of a fuel that contains carbon, e.g. a fossil fuel or wood, oe
- (a) **A1** the carbon in the fuel reacts with oxygen during burning, releasing carbon dioxide gas into the atmosphere, oe
- **(a) Answer: Burning a carbon-containing fuel makes the carbon react with oxygen, releasing carbon dioxide into the atmosphere.**
- (b) **M1** decomposers (microorganisms such as bacteria and fungi) break down (feed on) dead organisms and waste material, oe
- (b) **A1** the decomposers respire aerobically, releasing carbon dioxide as a waste product into the atmosphere, oe
- **(b) Answer: Decomposers break down dead organisms and waste, and respire, releasing carbon dioxide into the atmosphere.**

Question 4

- (a) **B1** 40 degrees C cao
- (a) **B1** it has the shortest time for the colour change, showing it was the fastest rate of reaction, oe
- **(a) Answer: 40 degrees C, because this gave the shortest time for the colour to change, showing the fastest rate of reaction.**
- (b) **M1** above the optimum temperature, the lipase molecules begin to denature, oe
- (b) **M1** the shape of the enzyme's active site is altered (changed), oe
- (b) **A1** so the substrate (fat/lipid) molecules no longer fit and bind as well, reducing the number of successful enzyme-substrate complexes formed and so the rate of reaction, oe
- **(b) Answer: Above 40 degrees C the lipase starts to denature, changing the shape of its active site, so fat molecules no longer bind as well and fewer enzyme-substrate complexes form, reducing the rate of reaction.**

Question 5

- (a) **M1** substitutes: (92 / 110) x 100
- (a) **A1** 83.6% (accept 84% or answers rounding to this) cao
- **(a) Answer: 83.6%**
- (b) **B1** both ponds have a species richness of 4
- **(b) Answer: Both ponds have a species richness of 4.**
- (c) **M1** in Pond A the individuals are spread much more evenly across the 4 species (30, 28, 26, 26), whereas in Pond B most individuals (83.6%) belong to a single dominant species, oe
- (c) **A1** biodiversity depends on the evenness of numbers across species as well as the number of species (richness), so Pond A, with more even numbers, is more biodiverse despite having the same richness as Pond B, oe
- **(c) Answer: Pond A's individuals are spread evenly across its 4 species, while Pond B is dominated by one species (83.6% of individuals); biodiversity depends on evenness as well as richness, so Pond A is more biodiverse.**

Question 6

- (a) **M1** the fertiliser (containing nitrate/phosphate) causes rapid growth of algae at/near the surface (an algal bloom), oe
- (a) **M1** the algae block light from reaching plants growing below the surface, so those plants die, oe
- (a) **M1** microorganisms (decomposers) break down the dead plant and algal matter and use up dissolved oxygen in the water through aerobic respiration, oe
- (a) **A1** the decomposing material and oxygen-depleted water are carried downstream by the current, so oxygen becomes most depleted, and fish die from lack of oxygen, some distance downstream rather than exactly at the spill site, oe
- **(a) Answer: Fertiliser causes an algal bloom, which blocks light so plants below die; decomposers break down the dead plant material and use up dissolved oxygen through respiration. This oxygen-depleted water is carried downstream, so fish die from lack of oxygen some distance from the spill.**

Question 7

- (a) **M1** identifies a source of uncontrolled variation, e.g. weather conditions on the count day differ from year to year, or volunteers' skill at identifying species varies, or the gardens taking part change from year to year, oe
- (a) **A1** explains the effect: this affects how many butterflies are recorded independently of any real change in biodiversity, so year-to-year comparisons of the average are not reliable, oe
- **(a) Answer: Weather on the count day varies from year to year and affects how active butterflies are, so the number recorded reflects the weather as well as real changes in biodiversity, making year-to-year comparisons unreliable.**
- (b) **B1** one valid change: always count at the same time of year and time of day, in similar weather conditions; provide standard identification guides/training for volunteers; use the same set of gardens each year, oe
- **(b) Answer: Ask volunteers to count at the same time of year, at a similar time of day and in similar weather conditions each year.**

Question 8

- **Level 3** (5-6): A balanced evaluation that considers benefits and drawbacks of both schemes (e.g. timescale, habitats created, other effects such as flood risk or land use), and reaches a justified recommendation.
- **Level 2** (3-4): Some evaluation of both schemes with at least one clear point on each, but the evaluation is not fully balanced or the recommendation is only partly justified.
- **Level 1** (1-2): Simple, undeveloped points about only one scheme, or a recommendation with little or no justification.
- **Indicative content:**
  - Woodland planting creates habitat for woodland species (e.g. birds, insects, fungi) and stores carbon as the trees grow, but takes many years/decades to mature before its full biodiversity benefit is reached
  - Woodland requires ongoing management while young, e.g. protection from grazing animals and weeding, and uses land that could otherwise be farmed
  - A wetland reserve can create habitat for wading birds, amphibians and aquatic insects relatively quickly, sometimes within a few years
  - A wetland can also reduce flood risk further downstream by storing floodwater, an additional benefit beyond biodiversity
  - A wetland may require monitoring of water quality and could affect the same field's use for farming/grazing, and is only suitable on low-lying land prone to flooding
  - A justified conclusion could recommend the wetland if a faster and additional flood-risk benefit is prioritised, or the woodland if long-term carbon storage and land available is prioritised; either is valid if properly supported

Question 9

- (a) **M1** calculates the decrease: 1 600 000 - 560 000 = 1 040 000
- (a) **M1** substitutes: (1 040 000 / 1 600 000) x 100
- (a) **A1** 65% cao
- **(a) Answer: 65% decrease**
- (b) **M1** fragmentation makes it harder for hedgehogs to move between habitat patches, e.g. because roads and solid garden fences act as barriers, oe
- (b) **A1** this isolates small populations, reducing access to mates and food and reducing genetic diversity (more inbreeding), which increases the risk of local extinction in each isolated patch, oe
- **(b) Answer: Roads and fences prevent hedgehogs moving between habitat patches, isolating small populations. This reduces access to mates and food and reduces genetic diversity, increasing the risk of local extinction in each patch.**

Question 10

- (a) **M1** substitutes: 132 x 250
- (a) **M1** calculates: 132 x 250 = 33 000 g
- (a) **A1** converts and states: 33 kg cao
- **(a) Answer: 33 kg**
- (b) **B1** one valid suggestion: drive at a steady, fuel-efficient speed; use a more fuel-efficient or electric vehicle; remove unnecessary weight or roof racks; share the journey with other passengers, oe
- **(b) Answer: Example: share the journey with other passengers, so the emissions are spread across more people per journey made.**

Question 11

- (a) **M1** calculates the total increase: 414 - 354 = 60 ppm
- (a) **M1** divides by the number of years: 60 / 30
- (a) **A1** 2.0 ppm per year cao
- **(a) Answer: 2.0 ppm per year**
- (b) **B1** 434 ppm (414 + (2.0 x 10)) ecf from (a)
- **(b) Answer: 434 ppm**