



GEO.PH4 Ecosystems and Tropical Rainforests

AQA 8035 · Calculator allowed · about 65 minutes

Total Marks

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Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

1 This question is about the basic components of an ecosystem.

(a) State what is meant by an ecosystem. (1)

(b) Name the role played by a green plant in an ecosystem's food chain, and explain why it has this role. (2)

(Total for Question 1 is 3 marks)

2 This question is about nutrient cycling in a small-scale UK ecosystem, such as a deciduous woodland.

(a) Name the FOUR main stores in a nutrient cycle. (4)

(b) In a UK deciduous woodland, explain why the litter store is typically largest in autumn. (2)

(Total for Question 2 is 6 marks)

- 3** Describe the global pattern of distribution of biomes (large-scale ecosystems), such as tropical rainforest, hot desert and tundra.

(Total for Question 3 is 3 marks)

- 4** This question is about the characteristics of tropical rainforests.

(a) State TWO characteristics of a tropical rainforest's climate. (2)

(b) Name the FOUR layers of a tropical rainforest, from highest to lowest. (4)

(Total for Question 4 is 6 marks)

- 5** Tropical rainforests are estimated to be home to more than half of the world's plant and animal species, despite covering only a small proportion of the Earth's land surface.

(a) Explain why tropical rainforest soils are often surprisingly nutrient-poor, despite the huge amount of vegetation the biome supports. (3)

(b) Describe TWO plant adaptations to the tropical rainforest environment. (4)

(Total for Question 5 is 7 marks)

6 This question is about the causes of deforestation in tropical rainforests.

(Total for Question 6 is 4 marks)

7 Explain TWO impacts of deforestation.

(Total for Question 7 is 4 marks)

8 Explain how deforestation of tropical rainforests can contribute to climate change.

(Total for Question 8 is 3 marks)

9 A hypothetical, illustrative area of rainforest covered 80,000 square kilometres in 1990. By 2020, deforestation had reduced this to 56,000 square kilometres. These figures are for practice only.

(a) Calculate the area of rainforest lost between 1990 and 2020. (2)

(b) Calculate the percentage of the 1990 rainforest area that had been lost by 2020. (3)

(Total for Question 9 is 5 marks)

10 This question is about a named tropical rainforest you have studied.

(a) Name a tropical rainforest you have studied, and state its main location. (2)

(b) Describe TWO causes of deforestation in this rainforest. (4)

(Total for Question 10 is 6 marks)

11 Using the same rainforest named in your answer to Question 10, explain TWO strategies that could be used to manage it more sustainably.

(Total for Question 11 is 5 marks)

12 Explain how ecotourism can contribute to the sustainable management of a tropical rainforest.

(Total for Question 12 is 3 marks)

13 Use the case study of the Amazon rainforest (or another named tropical rainforest you have studied) to answer this question.

'The value of tropical rainforests to the whole world justifies restricting how the countries that contain them can develop.' Assess the extent to which you agree with this statement.

(Total for Question 13 is 9 marks)

Mark scheme · GEO.PH4 Ecosystems and Tropical Rainforests

Question 1

- (a) **B1** a community of living organisms interacting with each other and with their physical (non-living) environment, oe
- (a) **Answer: A community of living organisms interacting with each other and with their physical environment.**
- (b) **B1** producer
- (b) **B1** it makes its own food using energy from sunlight (photosynthesis), so it is the first organism in the food chain, oe
- (b) **Answer: Producer; it makes its own food using energy from sunlight through photosynthesis, so it is the first organism in the food chain.**

Question 2

- (a) **B1** biomass (living plant and animal matter)
- (a) **B1** litter (dead leaves, twigs and organic matter on the surface)
- (a) **B1** soil
- (a) **B1** the atmosphere/air (nutrients in gas form, or dissolved and carried by rainfall)
- (a) **Answer: Biomass, litter, soil, and the atmosphere (air).**
- (b) **B1** deciduous trees shed their leaves in autumn, oe
- (b) **B1** this adds a large amount of dead organic matter to the surface all at once, before it has had time to decompose into the soil, oe
- (b) **Answer: Deciduous trees shed their leaves in autumn, adding a large amount of dead organic matter to the surface all at once, before it has had time to decompose into the soil store.**

Question 3

- **B1** biomes are broadly arranged in bands, or zones, related to latitude, oe
- **B1** tropical rainforests are found close to the Equator, where temperatures and rainfall are consistently high, oe
- **B1** colder biomes such as tundra are found at high latitudes, closer to the poles, where temperatures are consistently low, oe
- **Answer: Biomes are broadly arranged in bands related to latitude: tropical rainforests occur close to the Equator, where temperature and rainfall are consistently high, while colder biomes such as tundra occur at high latitudes, closer to the poles.**

Question 4

- (a) **B1** high, consistent temperatures throughout the year, typically around 27 degrees C, oe
- (a) **B1** very high annual rainfall, typically over 2000 mm, with little seasonal variation, oe
- (a) **Answer: High, consistent temperatures throughout the year, typically around 27 degrees C, and very high annual rainfall, typically over 2000 mm, with little seasonal variation.**
- (b) **B1** emergent layer (tallest trees, above the main canopy)
- (b) **B1** canopy layer (a continuous layer of tree tops)
- (b) **B1** under-canopy (under-storey)
- (b) **B1** shrub (forest floor) layer
- (b) **Answer: Emergent layer, canopy layer, under-canopy (under-storey), and the shrub (forest floor) layer.**

Question 5

- (a) **B1** high temperatures and heavy rainfall cause rapid decomposition of leaf litter, oe
- (a) **B1** nutrients released are quickly taken up again by the dense, fast-growing vegetation, so very little builds up in the soil, oe
- (a) **B1** heavy rainfall also leaches (washes) nutrients out of the upper soil layers, oe
- **(a) Answer: High temperatures and heavy rainfall cause rapid decomposition, but the nutrients released are quickly taken up again by the dense vegetation rather than building up in the soil, and heavy rainfall also leaches (washes) nutrients out of the upper soil layers.**
- (b) **B1** adaptation 1 named, e.g. drip-tip leaves, oe
- (b) **B1** linked function, e.g. pointed leaf tips let heavy rainfall run off quickly, preventing fungus and bacteria building up on the leaf, oe
- (b) **B1** adaptation 2 named, e.g. buttress roots, oe
- (b) **B1** linked function, e.g. wide, flat roots spreading from the base of tall trees provide extra support in shallow, nutrient-poor soil, oe
- **(b) Answer: For example: drip-tip leaves, whose pointed tips let heavy rainfall run off quickly, preventing fungus and bacteria building up; and buttress roots, wide flat roots that support tall trees growing in shallow soil.**

Question 6

- **B1** cause 1, e.g. cattle ranching and commercial farming, to grow crops or raise livestock for export, oe
- **B1** linked detail, e.g. large areas of forest are cleared, often by burning, to create pasture or farmland, oe
- **B1** cause 2, e.g. logging (legal and illegal) and road building, oe
- **B1** linked detail, e.g. roads built to access logging or mining sites also open up previously inaccessible forest to further clearance by settlers, oe
- **Answer: For example: cattle ranching and commercial farming, where large areas are cleared, often by burning, to create pasture or cropland; and logging and road building, where roads built to access timber or mineral sites also open up the forest to further clearance by settlers.**

Question 7

- **B1** impact 1, e.g. soil erosion, oe
- **B1** linked detail, e.g. with the tree canopy and roots removed, heavy rainfall washes away the exposed, already thin topsoil, oe
- **B1** impact 2, e.g. loss of biodiversity, oe
- **B1** linked detail, e.g. many species lose their habitat, threatening extinction, since rainforests support such a high concentration of the world's plant and animal species, oe
- **Answer: For example: soil erosion, since removing the tree canopy and roots exposes the already thin topsoil to being washed away by heavy rainfall; and loss of biodiversity, as many species lose their habitat, which is especially serious given how much of the world's plant and animal life the biome supports.**

Question 8

- **B1** trees absorb and store carbon dioxide as they grow, acting as a carbon sink, oe
- **B1** fewer trees means less carbon dioxide is absorbed from the atmosphere, oe
- **B1** when trees are cleared by burning, the carbon stored in them is also released directly into the atmosphere as carbon dioxide, adding to the enhanced greenhouse effect, oe
- **Answer: Trees absorb and store carbon dioxide as they grow, acting as a carbon sink; fewer trees means less carbon dioxide is absorbed, and clearing by burning releases the carbon stored in the trees directly into the atmosphere, adding to the enhanced greenhouse effect.**

Question 9

- (a) **M1** 80000 - 56000 seen, oe
- (a) **A1** 24,000 square kilometres cao
- **(a) Answer: 24,000 square kilometres.**
- (b) **M1** 24000 / 80000 seen, oe
- (b) **M1** answer x 100, oe
- (b) **A1** 30% cao
- **(b) Answer: 30%.**

Question 10

- (a) **B1** the Amazon rainforest
- (a) **B1** South America, spanning several countries including Brazil (the largest share), Peru and Colombia
- **(a) Answer: The Amazon rainforest, spanning several South American countries including Brazil, Peru and Colombia.**
- (b) **B1** names the same location consistently
- (b) **B1** cause 1, e.g. large areas have been cleared for cattle ranching, a major driver of deforestation in the Brazilian Amazon since the 1970s, oe
- (b) **B1** cause 2, e.g. commercial farming, particularly soy production, has also driven clearance, oe
- (b) **B1** cause 3, e.g. road building, such as the Trans-Amazonian Highway, has opened up previously remote forest to settlement and further clearance, oe
- **(b) Answer: In the Amazon (Brazil): large areas have been cleared for cattle ranching, a major driver of deforestation since the 1970s; commercial farming, particularly soy production, has also driven clearance; and road building, such as the Trans-Amazonian Highway, has opened up previously remote forest to settlement and further clearance.**

Question 11

- **B1** names the same location consistently
- **B1** strategy 1, e.g. selective logging and replanting, oe
- **B1** linked detail, e.g. only mature trees of a certain size are felled, and new trees are planted to replace them, allowing timber production to continue without clear-felling the whole area, oe
- **B1** strategy 2, e.g. protected areas/national parks and indigenous reserves, oe
- **B1** linked detail, e.g. these legally restrict clearance and settlement in designated zones of the rainforest, oe
- **Answer: For example, in the Amazon: selective logging and replanting, where only mature trees of a certain size are felled and new trees are planted to replace them; and protected areas and indigenous reserves, which legally restrict clearance and settlement in designated zones of the rainforest.**

Question 12

- **B1** ecotourism generates income from visitors wanting to experience the rainforest's wildlife and scenery, without clearing it, oe
- **B1** this gives local communities and governments a financial incentive to protect the forest rather than clear it for farming or logging, oe
- **B1** it can also create local jobs, e.g. as guides or in lodges, reducing reliance on activities that damage the forest, oe
- **Answer: Ecotourism generates income from visitors wanting to experience the rainforest without clearing it, giving local communities and governments a financial incentive to protect the forest, and creates local jobs such as guiding, reducing reliance on activities that damage the forest.**

Question 13

- **Level 4** (7-9): A detailed, well-balanced assessment that uses accurate, detailed reference to a named rainforest; weighs the rainforest's global value (biodiversity, carbon storage, climate regulation) against the development needs and sovereignty of the countries that contain it, and reaches a clear, justified conclusion.
- **Level 3** (5-6): A clear assessment that uses accurate reference to a named rainforest; both the global value and the development argument are considered, and a conclusion is reached, though the balance may be less developed.
- **Level 2** (3-4): Some relevant points about rainforest value and/or development are made, with limited or generalised use of a named example; a simple conclusion is given with little justification.
- **Level 1** (1-2): One or two isolated relevant points about rainforests are made, with little or no use of a named example.
- **Level 0** (0): No relevant content.
- **Indicative content:**
 - The Amazon rainforest stores a very large amount of carbon and supports an exceptionally high proportion of the world's biodiversity, so its loss has consequences (for climate and species) that extend far beyond the countries that contain it.
 - Supports the statement: since the whole world benefits from the rainforest's carbon storage and biodiversity, and the whole world is harmed by its loss (through worsened climate change), it can be argued that outside restriction or support is justified, especially if paired with international funding (e.g. debt-for-nature swaps, REDD+ style forest-carbon payments) to compensate the host countries.
 - Challenges the statement: rainforest countries, including Brazil, are sovereign states with the right to use their own land and resources for development, poverty reduction and economic growth, in the same way that many higher-income countries cleared their own forests in the past; restrictions imposed without adequate compensation could be seen as unfair.
 - A middle position: international cooperation, sustainable management (selective logging, protected areas, ecotourism) and financial support for the host countries can allow both conservation and development, rather than treating them as a strict trade-off.
 - A well-supported conclusion should weigh the strength of the global-value argument against the sovereignty and development-needs argument, and may reasonably conclude that some form of internationally funded compromise is more realistic than either full restriction or unrestricted development.
 - Reference to named strategies from this pack (selective logging and replanting, protected areas, ecotourism) should be used to support whichever conclusion is reached.