Example Candidate Responses

Cambridge International AS Level

Cambridge International AS Level Environmental Management

8291

Paper 2: Hydrosphere and Biosphere

Cambridge Advanced

CAMBRIDGE International Examinations

Version 1.1
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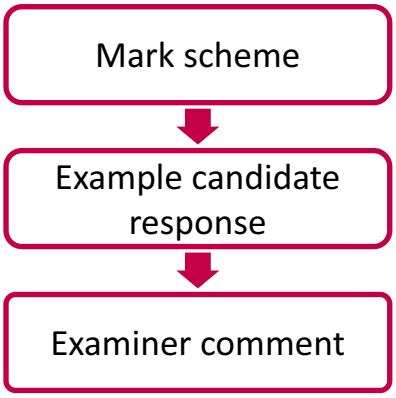
Contents

Introduction

The main aim of this booklet is to exemplify standards for those teaching Cambridge International AS Level Environmental Management (8291), and to show how different levels of candidates' performance relate to the subject's curriculum and assessment objectives.

In this booklet a range of candidate responses (high, middle and low) has been chosen from Paper 2. Each response is accompanied by a brief commentary explaining the strengths and weaknesses of the answer.

For ease of reference the following format for each component has been adopted:



For each question an extract from the mark scheme, as used by examiners, is followed by examples of marked candidate responses, each with an examiner comment on performance. Comments are given to indicate where and why marks were awarded, and how additional marks could have been obtained. In this way, it is possible to understand what candidates have done to gain their marks and what they still have to do to improve their grades.

Past papers, Examiner Reports and other teacher support materials are available at **https://teachers.cie.org.uk**

Assessment at a glance

All candidates take

Paper 1	1 hour 30 minutes	Paper 2	1 hour 30 minutes
Lithosphere and atmosphere Paper 1 is divided into two sections. Section A: short answer questions based on sets of data, diagrams or extracts. Section B: Candidates choose one essay question from a choice of three. Each essay question is in two parts. Questions will be drawn from parts of the syllabus not covered in Section A. 80 marks		**Hydrosphere and biosphere** Paper 2 is divided into two sections. Section A: short answer questions based on sets of data, diagrams or extracts. Section B: Candidates choose one essay question from a choice of three. Each essay question is in two parts. Questions will be drawn from parts of the syllabus not covered in Section A. 80 marks	

and

Paper 3: Coursework	Centre-based assessment
Candidates produce a research report of c2000 words covering an issue arising during their course of study. The report may focus on a local, regional or global issue. It may be based on secondary source material and/or internet data, although the use of primary sources and field data collection should be undertaken where practicable. Proposals for Coursework topics must be submitted to Cambridge in advance. 40 marks	

Teachers are reminded that the latest syllabus for 8291 is available on our public website at **www.cie.org.uk** and Teacher Support at **https://teachers.cie.org.uk**

Paper 2: Hydrosphere and Biosphere

Section A

Question 1

Mark scheme

1 (a) (i) A: perched
B: unconfined
C: confined

Award two marks if all three aquifers are correct. For one correct aquifer award one mark. [2]

(ii) Perched aquifer A: water is stored in a porous / permeable layer; above the main water table; confined aquifer C: impermeable rock above; and below the aquifer;
unconfined aquifer B: water is stored within a permeable / porous layer, below the water table; impermeable rock below the aquifer.

Award two marks for each type of aquifer.
*Accept ecf from **(a)(i)**.* [6]

(iii) A: accessibility; wells are shallow and easy to dig; useful for people to supply their own water; springs often emerge close by;
C: deep (underground water); water is filtered as it passes through the rocks; water is uncontaminated / pure water quality; can easily flow due to pressure / artesian wells; quantity of water.

Award one mark for each of two points. [2]

(b) (i) Renewable water; from an external source; water from precipitation; infiltrating / percolating (into, the groundwater store or aquifer). [2]

(ii) Groundwater store / natural recharge: gains from; precipitation; infiltration, percolation, seepage; from surface water, rivers, lakes; from artificial water storage; groundwater flow from aquifers out of the area;
groundwater store losses: water is lost from groundwater naturally through evapotranspiration; to the river; groundwater flow to aquifers out of the area; loss due to the artificial storage of water;
extraction: water is lost due to human activity; for domestic supply; for agriculture; for use in the economy, e.g. industry;
conclusion: the impact upon the quantity of water stored in the groundwater; depletion of the groundwater store;
use of data:

gains	107 400 + 323 000	= 430 400;
losses	–548 700 – 97 000	= –645 700;
difference / overall loss	–645 700 + 430 400	=(–215 300 million litres).

A balanced answer will include each of the elements above. Award a maximum of five marks if no data from Fig. 1.2 is used.

Award six to eight marks for a response which shows a very good understanding of the question, good use of data and the information provided, and is a balanced answer.

Please use level descriptors 1

[8]

Example candidate response – high

1 (a) Fig. 1.1 shows three different types of aquifers.

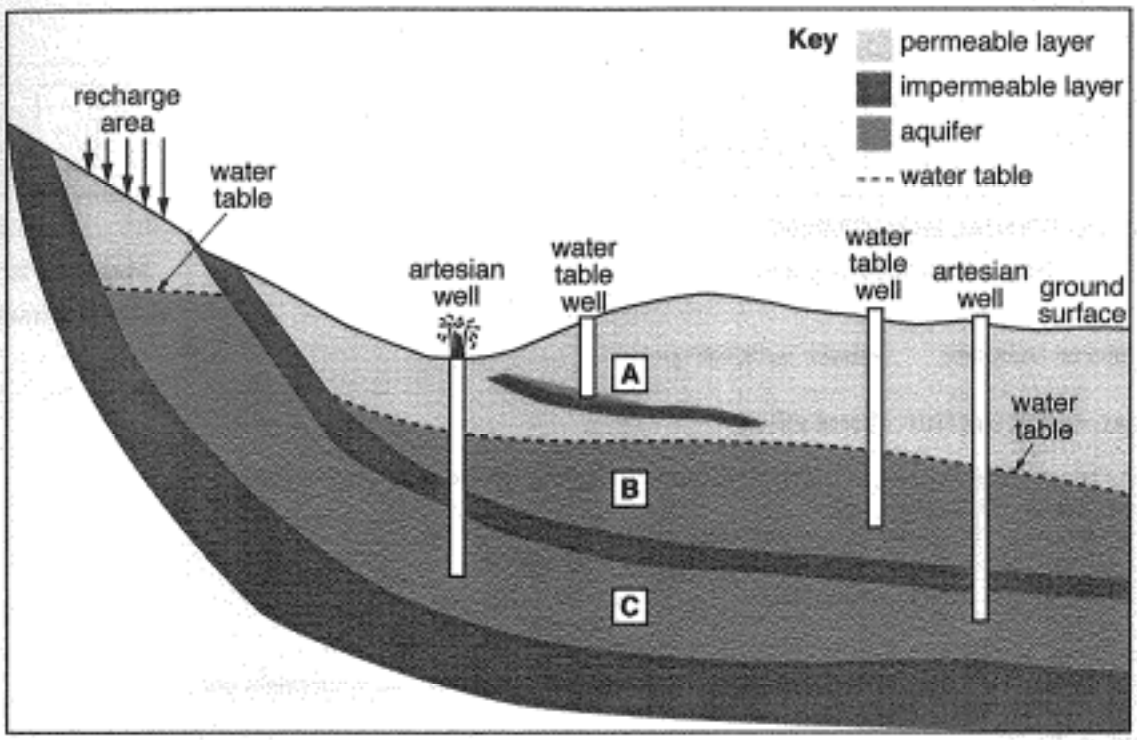


Fig. 1.1

(i) Identify the type of aquifer at positions **A**, **B** and **C** in Fig. 1.1.
Choose from the list below.

unconfined **confined** **perched**

A Perched ✓

B Unconfined

C Confined ✓

2✓

[2]

Example candidate response – high, continued

(ii) With reference to Fig. 1.1, describe the characteristic features of each of these three different types of aquifers.

perched A perched aquifers is the easiest aquifer to access, It is above the water table mark and the impermeable layer of rock such as shale and granite. It is located in the permeable layer of soil. ✗

confined A confined aquifer is below a impermeable ✓ layer of rock such as shale and granite, water cannot percolate through the impermeable layer making ✓ groundwater stored water making it a water reservoir.

unconfined A unconfined aquifer is located above the impermeable layer of rock which cannot percolate any further making it stored water, A unconfined ✗ aquifer is below the zone of aeration and marks where the water table begins. ✓ [6]

6

(iii) Outline the benefits of extracting water from the aquifers located at **A** and **C** in Fig. 1.1.

Extracting water from aquifer A is the cheapest way ✓ of extracting groundwater because it is easy to access. Water extracted from aquifer C is the cleanest water, containing little to no bacteria and ~~contaminants~~ contaminants such as lead. [2]

2 ✓

Example candidate response – high, continued

(b) Fig. 1.2 is adapted from a water cycle report for the Great Artesian Basin in Australia. It shows losses, gains, stores and flows of water in the area.

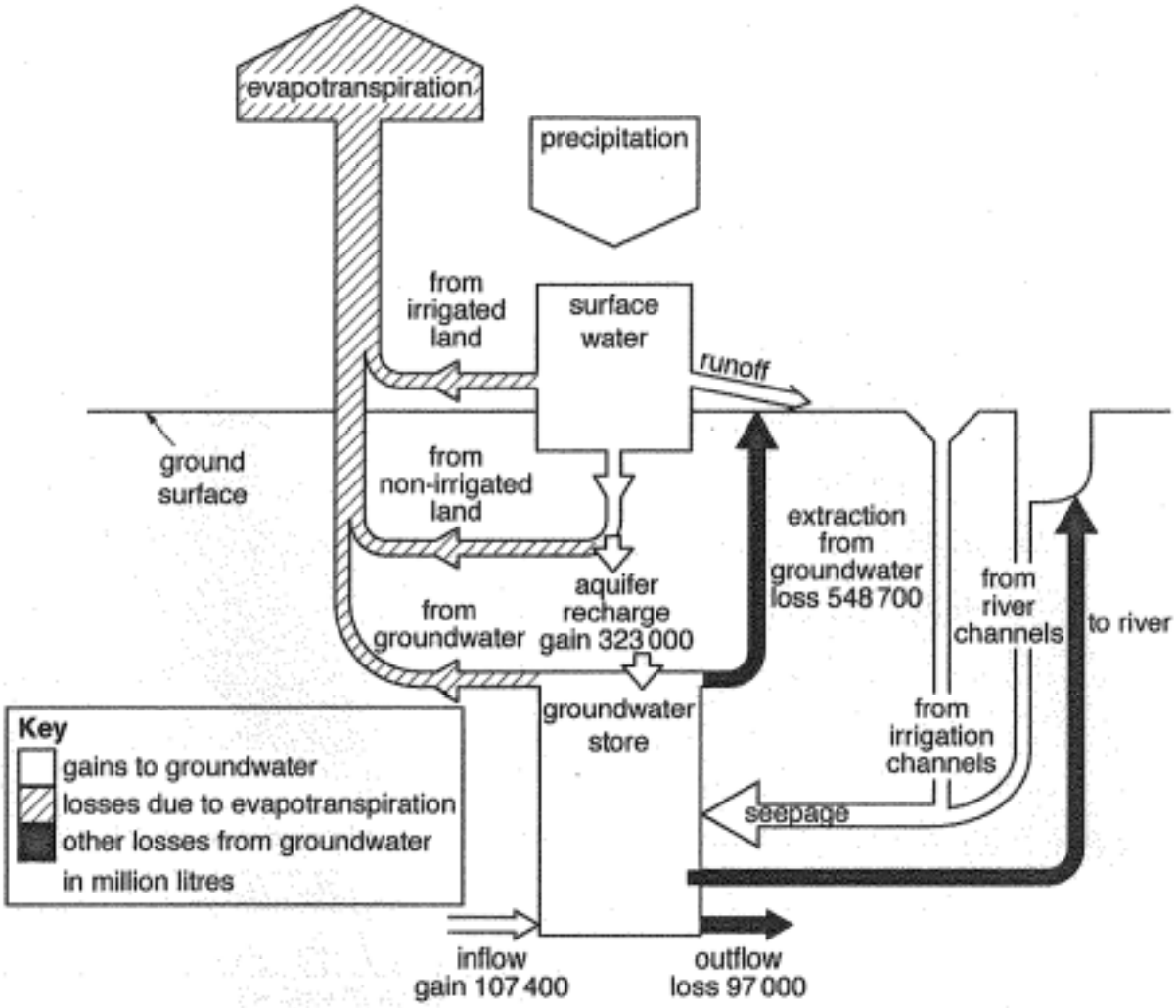


Fig. 1.2

(i) With reference to Fig. 1.2, explain what is meant by the term *aquifer recharge*.

Is the amount of water such as surface water that percolates underground through zone of aeration and water table eventually reaching an impermeable layer of rock becoming deeper and stored water refilling the aquifer. [2]

Example candidate response – high, continued

(ii) With reference to the information in Fig. 1.2, describe how natural processes and human activity are causing an overall loss of 215300 million litres from the groundwater store. In your answer refer to losses, extraction and natural recharge.

Human activities such as ~~the~~ irrigation ~~for~~ for crops cause the water to be extracted by wells leading the aquifer, at a much faster rate than the aquifer can recharge. ~~This loss of water causes the aquifer to be depleted contributing to the overall.~~ The rate at which water is being extracted from the aquifer is 578,700 litres of water loss, while the aquifer recharge rate is 323,000 gained. The amount of water loss is much greater than the amount of water gained to the aquifer. This depletion of water from the aquifer contributes to the overall loss of 215300 millions litres of groundwater stored. Also the natural process of evapotranspiration of plants takes away of the amount of water reaching the aquifer which means even less water is reaching the aquifer contributing to the 215300 million litres of stored groundwater loss affecting the natural recharge rate of the aquifer becoming less than the amount extracted resulting in the depletion of the aquifer [8]

[Total: 20]

19

Examiner comment – high

1(a) (i) This answer contains the correct identification of all three aquifer types.

(ii) This candidate has written a detailed description of the distinguishing characteristic features each of the three aquifers in relation to the permeable and impermeable layers in the source information. There is a correct reference to above the main water table and located within a permeable layer for the perched aquifer. The reference to the upper region of the permeable layer, where water table begins below the zone of aeration gives a clear indication of the nature of the permeable layer of unconfined aquifer above the impermeable rock below. The description of a confined aquifer shows understanding of the confining layers, the impermeable layers of rock preventing percolation of water and also gives examples of granite and shale.

(iii) The candidate has stated two benefits, ease of extraction and clean water. Two marks awarded for the two benefits.

1(b) (i) This candidate correctly refers to water percolating to refill the aquifer, although there is no indication where this water has come from, e.g. to an external source. However, the understanding of renewable water and how it reaches the aquifer are sufficient for the 2 marks.

(ii) The candidate describes and gives examples of losses from both natural processes – evapotranspiration and human activity – water for irrigation extracted from wells. Data is quoted for losses due to extraction and gain from recharge to partially show how the 215300 million litres is obtained. The data for the inflow and outflow could also have been incorporated into the calculation to demonstrate very good use of data. The candidate shows understanding that the overall losses are greater than gain, that extraction is greater than recharge resulting in aquifer depletion. Seven marks were awarded for a detailed answer, which shows good use of data and information from Fig. 1.2 and demonstrates a very good understanding.

Mark awarded = 7 out of 8

Total mark awarded = 19 out of 20

Example candidate response – middle

1 (a) Fig. 1.1 shows three different types of aquifers.

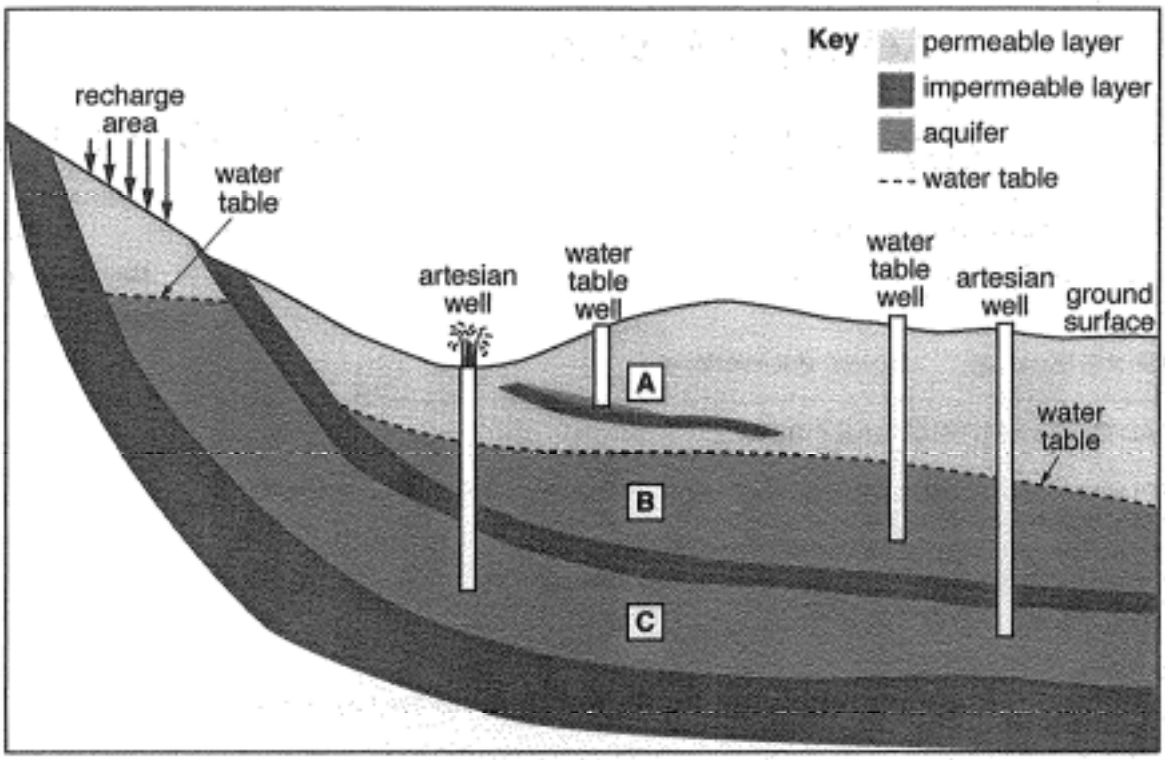


Fig. 1.1

(i) Identify the type of aquifer at positions **A**, **B** and **C** in Fig. 1.1.
Choose from the list below.

unconfined **confined** **perched**

A Perched ✓

B unconfined

C confined ✓

[2]

Example candidate response – middle, continued

(ii) With reference to Fig. 1.1, describe the characteristic features of each of these three different types of aquifers.

perched The perched aquifers are closest to the surface which cause for simple extraction from a shorter well. 0

confined Confined aquifers are the furthest from the surface and are sandwhiched between two impermeable layers and rise close to the recharge area. 2

unconfined Unconfined aquifers are between a permeable layer and an impermeable layer. These aquifers lay just below the water table. 4

[6]

(iii) Outline the benefits of extracting water from the aquifers located at **A** and **C** in Fig. 1.1.

Aquifers located at A are closest to the water table surface and require shorter^ wells while aquifers at C rise to the water table near the recharge area allowing a steady supply. [2] 1

Example candidate response – middle, continued

(b) Fig. 1.2 is adapted from a water cycle report for the Great Artesian Basin in Australia. It shows losses, gains, stores and flows of water in the area.

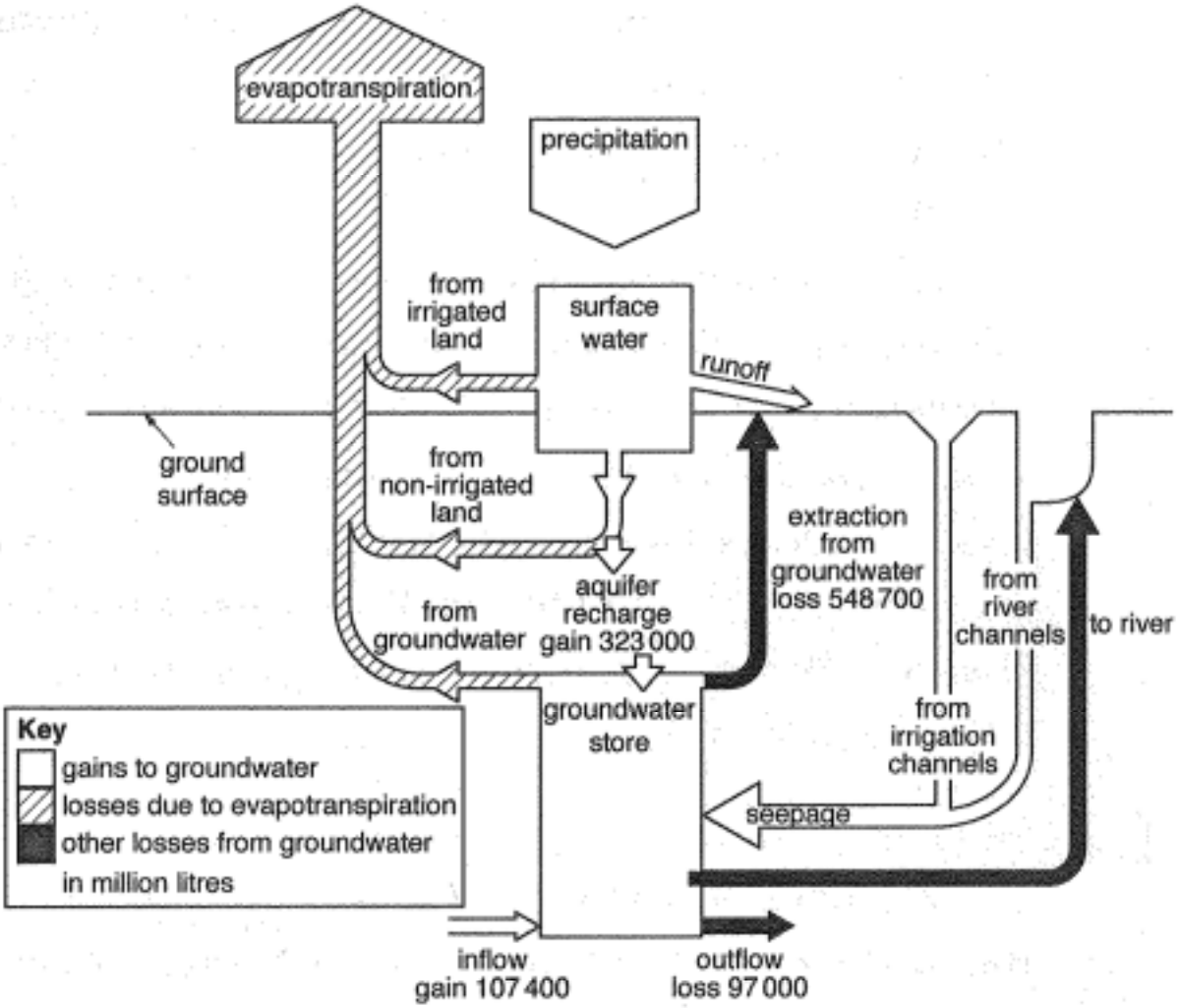


Fig. 1.2

(i) With reference to Fig. 1.2, explain what is meant by the term *aquifer recharge*.

Aquifer recharge refers to the surface water which seeps down into the groundwater store to supply to aquifers with water, in this case the aquifer ~~water~~ recharge is a gain of 323000 million litres. [2]

10

Example candidate response – middle, continued

(ii) With reference to the information in Fig. 1.2, describe how natural processes and human activity are causing an overall loss of 215300 million litres from the groundwater store. In your answer refer to losses, extraction and natural recharge.

Outflow into rivers from the groundwater store results in a loss of 97,000 million litres. Evapotranspiration extracts groundwater from the store as well. Human activity such as irrigated land extracts from surface water as well as groundwater storage. The aquifer recharge supplies the groundwater store with about 323,000 million litres. Human extraction of groundwater results in a loss of 548,700 million litres. Irrigation channels result in natural recharge of the groundwater store from seepage.

[8]

[Total: 20]

5 ✓

12 ✓

Examiner comment – middle

1(a) (i) All three types of aquifer are correctly identified for the two marks.

Mark awarded = 2 out of 2

(ii) This candidate has correctly described the confined aquifer as sandwiched between two impermeable layers and there is use of the source information referring to the permeable and impermeable layers for the unconfined aquifer. No marks are awarded for use of the perched aquifer as this point is more pertinent to part **(iii)** of the question. Overall 4 marks have been awarded for two of the three aquifers described with some accuracy.

Mark awarded = 4 out of 6

(iii) The reference to shorter wells/closer to the surface is equivalent to the benefit relating to ease of extraction from shallow wells for aquifer A. One mark was awarded for one valid benefit.

Mark awarded = 1 out of 2

1(b) (i) There is no specific mention of the source of aquifer recharge or explanation of recharge.

Mark awarded = 0 out of 2

(ii) The candidate was awarded 5 marks as the answer shows an adequate understanding of the question. The answer has some balance of content as both losses due to evapotranspiration and from irrigation and gain from recharge are described. The candidate uses some of the data for losses due to outflow and extraction together with gains from recharge to support their answer but does not show how the overall loss of 215300 million litres is achieved and does not give an overall conclusion the rate of extraction is greater than rate of natural recharge hence there is an overall depletion of the groundwater reserves.

Mark awarded = 5 out of 8

Total mark awarded = 12 out of 20

Example candidate response – low

1 (a) Fig. 1.1 shows three different types of aquifers.

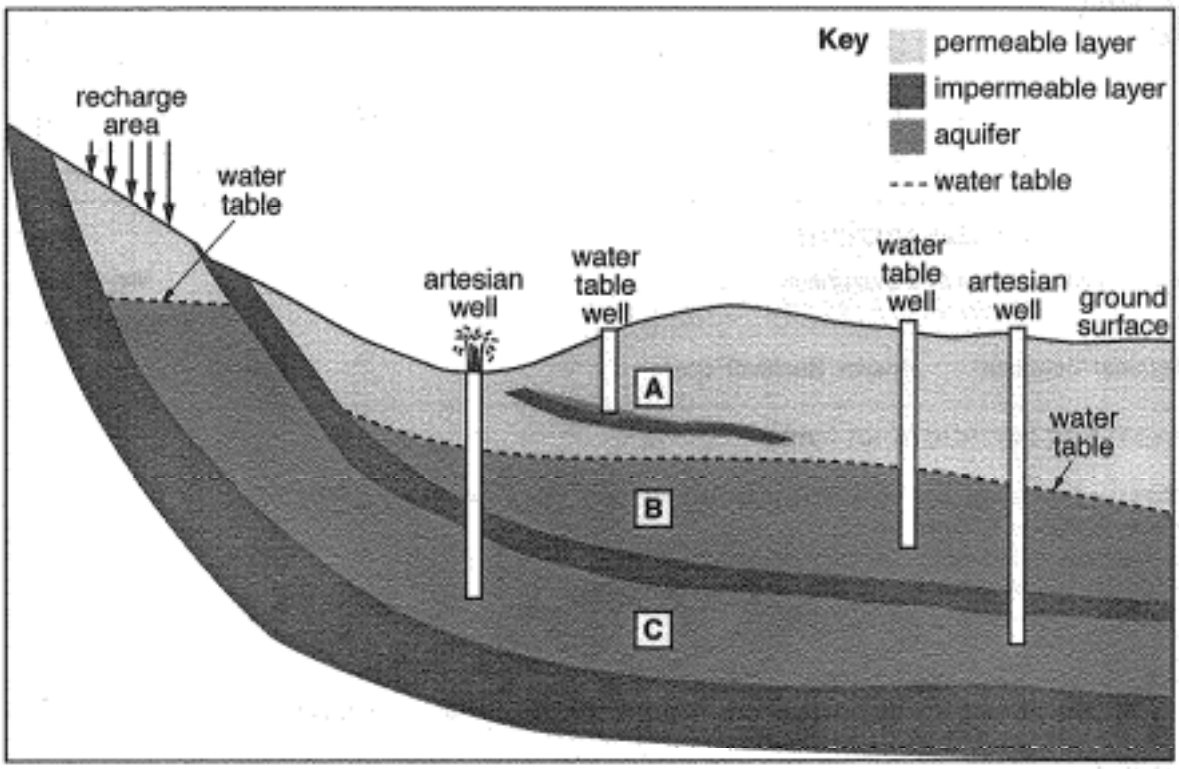


Fig. 1.1

(i) Identify the type of aquifer at positions **A**, **B** and **C** in Fig. 1.1.
Choose from the list below.

unconfined **confined** **perched**

A Perched ✓

B unconfined ✓

C confined ✓

2 [2]

Example candidate response – low, continued

(ii) With reference to Fig. 1.1, describe the characteristic features of each of these three different types of aquifers.

perched aquifers are one that are above the water table, and are the easiest to get to and use. It is not very deep within the ground, but is also not very big in size. 1

confined means it is deep within the ground, but it is also the biggest of the aquarers. It has the cleanest of the water, and is not as contaminated as the other two. 0

unconfined This is the second largest aquarer and is also easy to get to because it is not trapped between impermiable layers. 0

[6]

(iii) Outline the benefits of extracting water from the aquifers located at **A** and **C** in Fig. 1.1.

A because it is the cheapest because it is not deep within the ground. C because it has the best quality of water because pollutants can't make it as much through the impermiable layer. 2 [2]

Example candidate response – low, continued

(b) Fig. 1.2 is adapted from a water cycle report for the Great Artesian Basin in Australia. It shows losses, gains, stores and flows of water in the area.

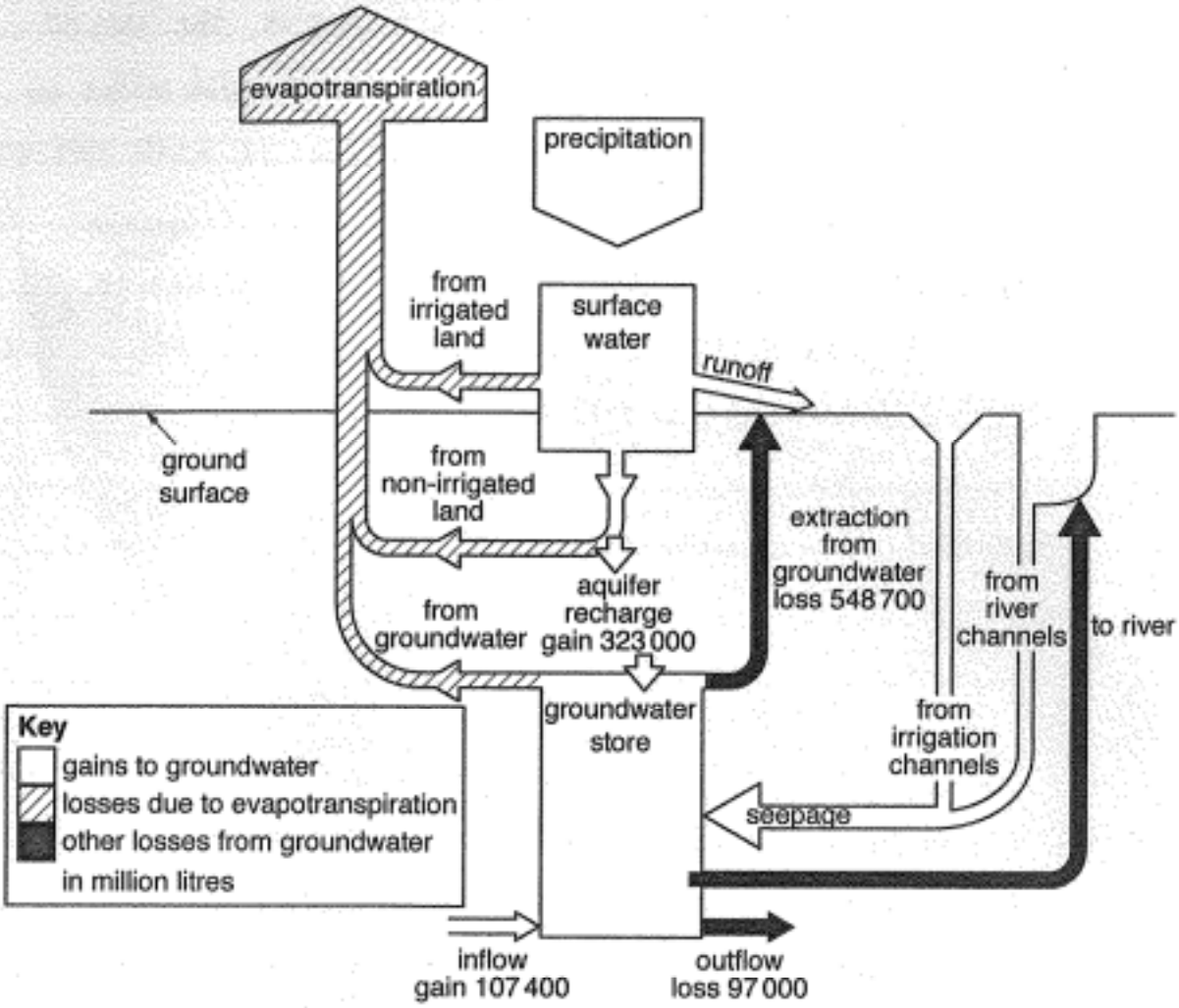


Fig. 1.2

(i) With reference to Fig. 1.2, explain what is meant by the term *aquifer recharge*.

aquifer recharge is where the water from the surface area seeps down into the ground, and refills the aquifer so it can give more water to the ground water store. [2]

Example candidate response – low, continued

(ii) With reference to the information in Fig. 1.2, describe how natural processes and human activity are causing an overall loss of 215300 million litres from the groundwater store. In your answer refer to losses, extraction and natural recharge.

For natural recharge: if runoffs that have a high amount of pollutants seep down into the ground from the river channels those pollutants could be damaging to the groundwater store and could contaminate the aquifers. Extraction: is coming from humans that are taking out more water from the aquifers than what ~~could~~ nature can handle which in turn leads to the lost of litres in the grand water store: humans could be using this water for drinking and many other uses. Losses: this could be coming from many different sources: More evapotranspiration due to the increase in salinity in plant that are having sea level rise: losses through accidental drilling which could cause a lose of water.

.....

.....[8]

4

[Total: 20]

10

Examiner comment – low

1(a) (i) This answer gives correct identification of the three types of aquifer for the two marks.

Mark awarded = 2 out of 2

(ii) In this answer there is reference to the relative positions of the perched aquifer being above the main water table and the unconfined aquifer below the water table. However, under the water table does not specifically distinguish a confined aquifer and no further detail is given. The remainder of the answer relates to part **(iii)** of the question about the use of the water from aquifers, rather than a description of the characteristic features of the aquifer and makes no reference to the layers of permeable and impermeable rock. The candidate was awarded 2 marks for a limited description

Mark awarded = 2 out of 6

(iii) Although the candidate does not specify which of aquifer A or C is being referred to, the reference to the quality is applicable as a benefit to both types of aquifers. 1 mark was awarded.

Mark awarded = 1 out of 2

1(b) (i) Most of this answer refers to the loss of water rather than a gain of water in aquifer recharge. The candidate has made a vague reference to flows back in but there is no explanation of the source of this water to replenish the aquifer.

Mark awarded = 0 out of 2

(ii) This response achieved three marks, as they show limited use of the data and information in Fig. 1.2. The candidate mentions losses from the aquifer due to human activity as a result of irrigation; natural losses due to evaporation and a gain from precipitation to recharge the aquifer. However, there is no detail in the answer and no use of data from Fig. 1.2. The answer shows limited understanding of the overall loss and depletion of the aquifer.

Mark awarded = 3 out of 8

Total mark awarded = 8 out of 20

Question 2

Mark scheme

2 (a) (i) e.g. land iguana ⟶ snake ⟶ hawk

Award two marks for three correct stages. Award one mark for two correct stages. [2]

(ii) Habitat: the place / area where the organism lives / an example of organism and habitat location from Fig. 2.1 / Fig. 2.2;

Niche: the role of the organism in the ecosystem; an example of the role in the ecosystem; reference to Fig. 2.1 to illustrate the concept of a niche; or an example of organisms with the same habitat but occupying different niches, e.g. Galapagos penguin, marine iguana, flightless cormorant from Fig. 2.2. [4]

(iii) The importance of both land and marine environments should be emphasised; e.g. organisms feeding at sea / living / breeding on land; an example of this relationship from Fig. 2.1 / Fig. 2.2; the impact of human activity upon the coastal environment; pollution from the land affecting the marine ecosystem, e.g. sewage; marine pollution, e.g. oil spill affecting the coastal shores.

Award one mark for each of two points and one mark for each elaboration or example used. [4]

(b) (i) Collecting specimens / litter / fishing without a permit / introduction of foreign organisms / feeding the organisms / disturbing the behaviour of species.

Award one mark for one suitable way and a further one mark for a developed point. [2]

(ii) Zoning pattern;
core area on the outside; vulnerable species found in the outer area; no visitors in the most vulnerable areas; largest area;
buffer zone: transition between the core and developed zone; allows ecotourism; education; research; community activity; allows activity which is not destructive, e.g. grazing;
developed zone at the centre; roads / human settlements / towns / port; human activity away from vulnerable areas; a relatively small area of the island; restricts development;
Charles Darwin research centre; monitoring of species.

A balanced answer should contain reference to all zones and use information from Fig. 2.3.

Please use level descriptors 1

[8]

Example candidate response – high

2 (a) Fig. 2.1 shows a food web for some of the organisms living on part of the Galapagos Islands. Fig. 2.2 shows the locations of some native species on the islands.

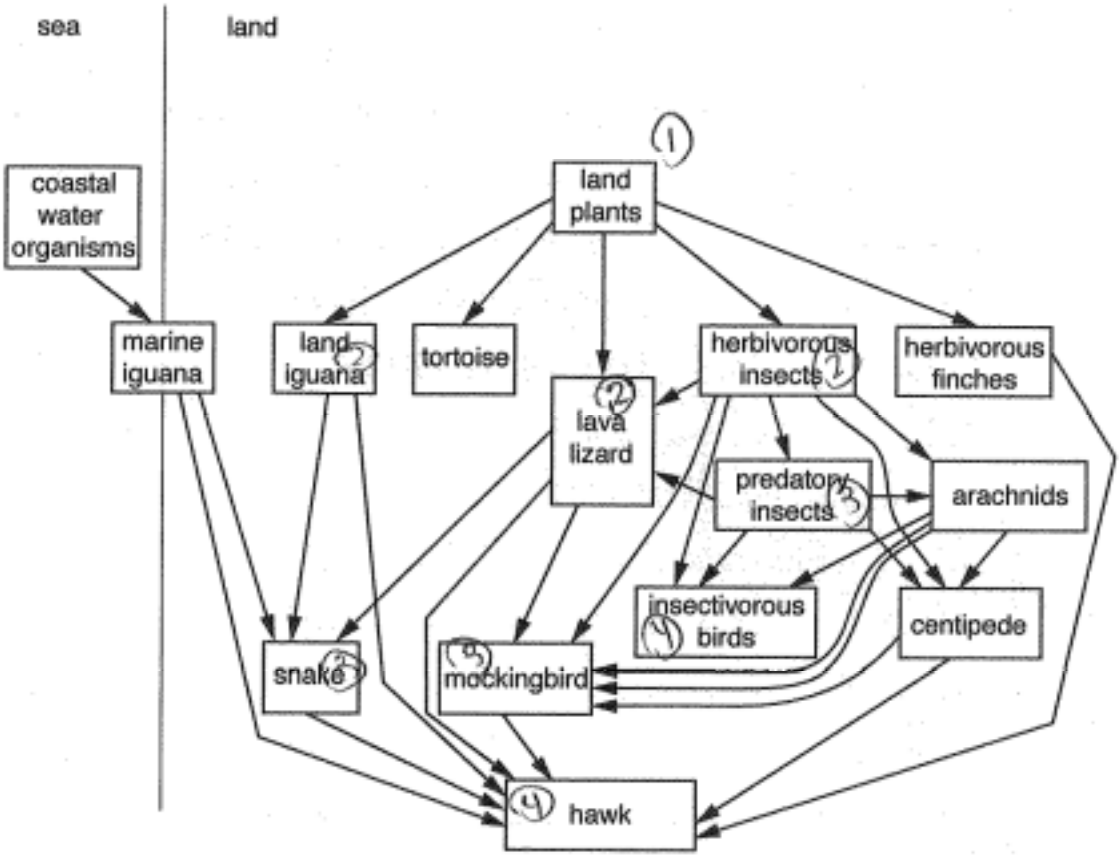


Fig. 2.1

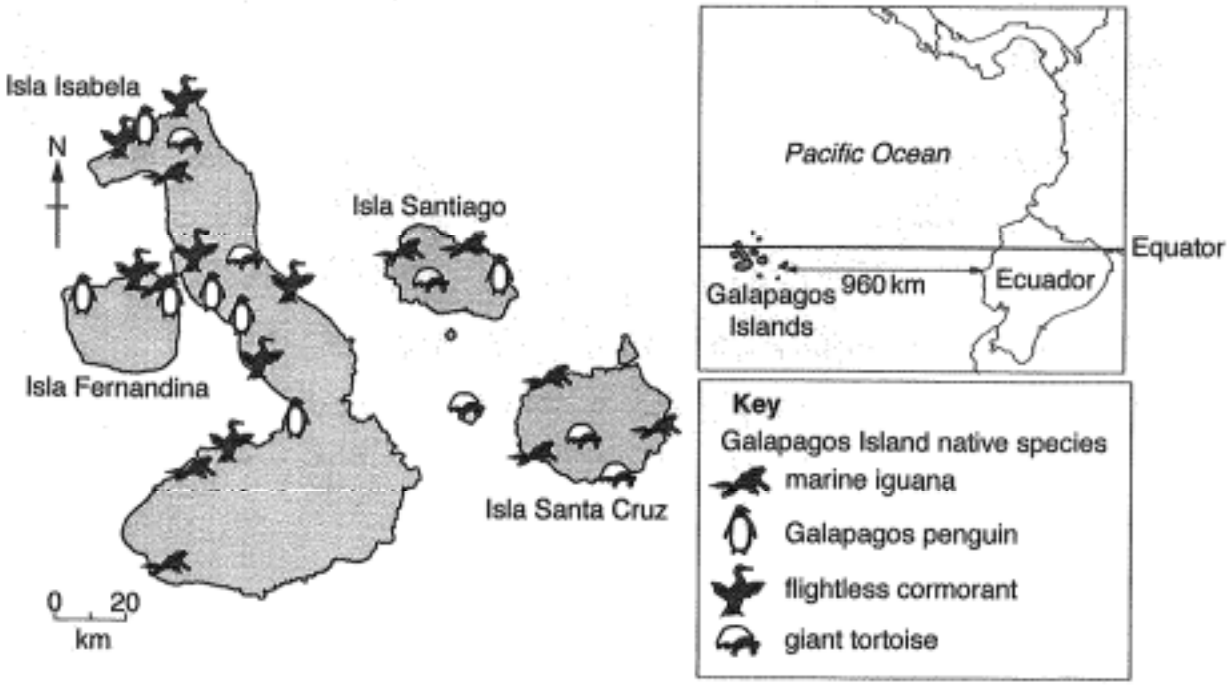
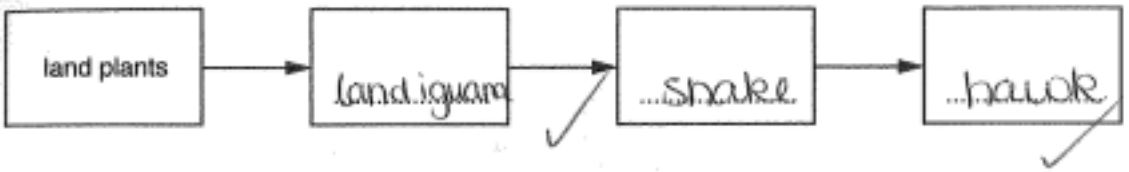


Fig. 2.2

Example candidate response – high, continued

(i) With reference to Fig. 2.1, complete the four-stage food chain.



[2] 2

(ii) With reference to Fig. 2.1 and Fig. 2.2, explain how the terms *habitat* and *niche* can be applied to the location of species in the Galapagos Islands.

habitat the habitat is where a species lives on the Galapagos, weither it be in a tree/etc

niche The nich is the role that the species plays

- this role varies from island to island depending on the ~~area~~ environment

3

[4]

(iii) A marine reserve has been established with a 64 km radius around the islands. With reference to Fig. 2.1 and Fig. 2.2, explain the need to conserve the Galapagos Islands' habitats **and** protect their coastal waters.

- the interlocking of species within the food web of Fig 2.1 shows the animals' dependence on each other, if one dies, many die
- these animals are too far away from other land to move as shown in Fig 2.2 so their habitats need to be protected
- many animals (inc. marine iguana) depend on their coastal waters to be conserved

[4] 3

(b) **(i)** Suggest **one** way in which tourism can pose a threat to the species in the Galapagos Islands.

- tourism generates much pollution due to transportation (fossil fuels/ other invasions) and littering
- trash would be generated

[2] 1

Example candidate response – high, continued

(ii) Fig. 2.3 shows the Galapagos Island of Santa Cruz. Describe how the strategy shown in Fig. 2.3 can protect the island's most vulnerable species.

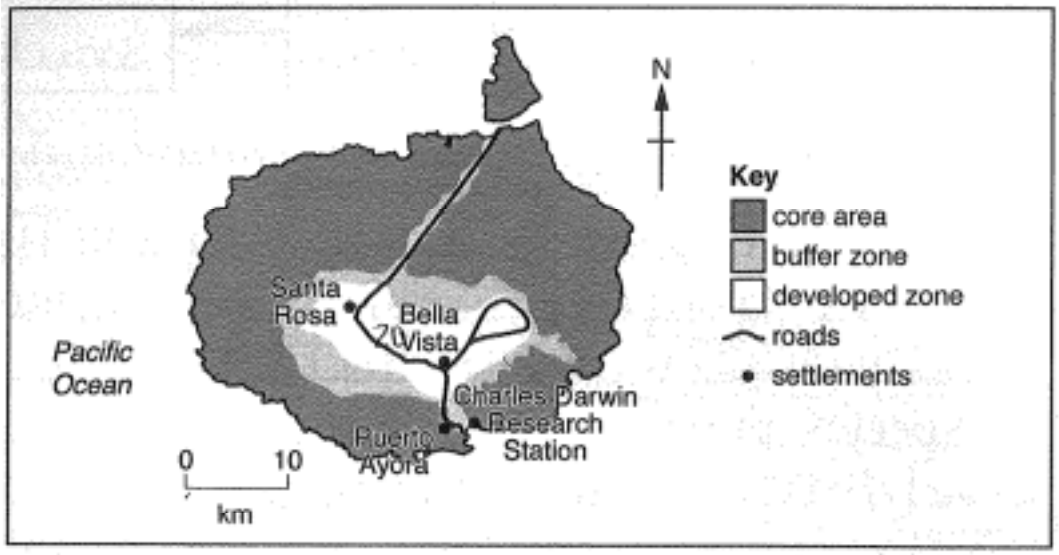


Fig. 2.3

- there is much land used for only the core zone whereas about 20km x 7.5km used as a developed zone, this gives species room to roam.
- the buffer zone provides a transition from core are to the developed zone so animals are still safe if they wander a bit (about 1-5 km) away from the core area & will start of warn them to turn back
- this protects animals from getting into traffic on the road or being hurt in the development
- The Research Station is within the buffer zone so it can gain info to help protect species but also not be so developed that species would be harmed [8]

[Total: 20]

Examiner comment – high

2(a) (i) A correct food chain has been stated using information from in Fig 2.1.

Mark awarded = 2 out of 2

(ii) The candidate has correctly stated the habitat, where the organism lives, and the niche as the role of the organism. There is further detail relating to the environment but no example to illustrate the concept that species must occupy different niche to prevent competition for resources, although different species can share the same habitat.

Mark awarded = 3 out of 4

(iii) The candidate has given a good explanation, illustrated by use of an example of the marine iguana depending upon coastal water organisms to emphasise the interdependence of organisms in the food web.

Mark awarded = 3 out of 4

2(b) (i) The candidate has referred to two examples of different types of pollution from transport and litter instead of referring to one type of pollution and the threat to the species. There is no indication of the actual threat or the effect upon the species.

Mark awarded = 1 out of 2

2(b) (ii) This candidate meets the criteria for the middle of the top level and 7 marks were awarded. The answer has balance, refers to all three zones and demonstrates some effective use of data from Fig 2.3. The candidate shows a very good understanding of the question referring to the core as the largest area, the buffer as a transition zone and developed area as the smallest zone. There is use of the scale to consider the area of the developed zone and the distance across the buffer zone. The significance of the role of the research station in conservation and protecting the species station has been identified. However, there was no consideration of the positions of the core zones on the outside with access to the coastal waters.

Mark awarded = 7 out of 8

Total mark awarded = 16 out of 20

Example candidate response – middle

2 (a) Fig. 2.1 shows a food web for some of the organisms living on part of the Galapagos Islands. Fig. 2.2 shows the locations of some native species on the islands.

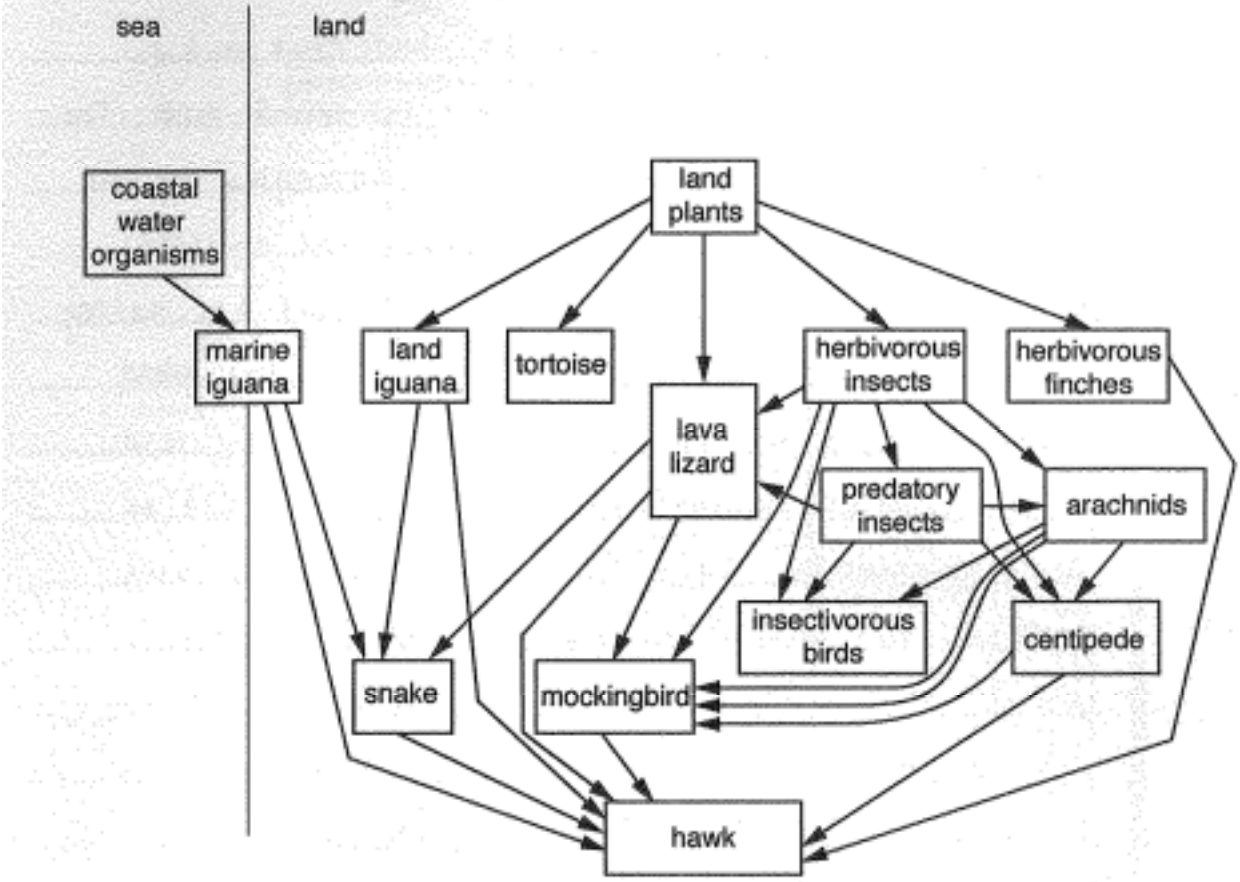


Fig. 2.1

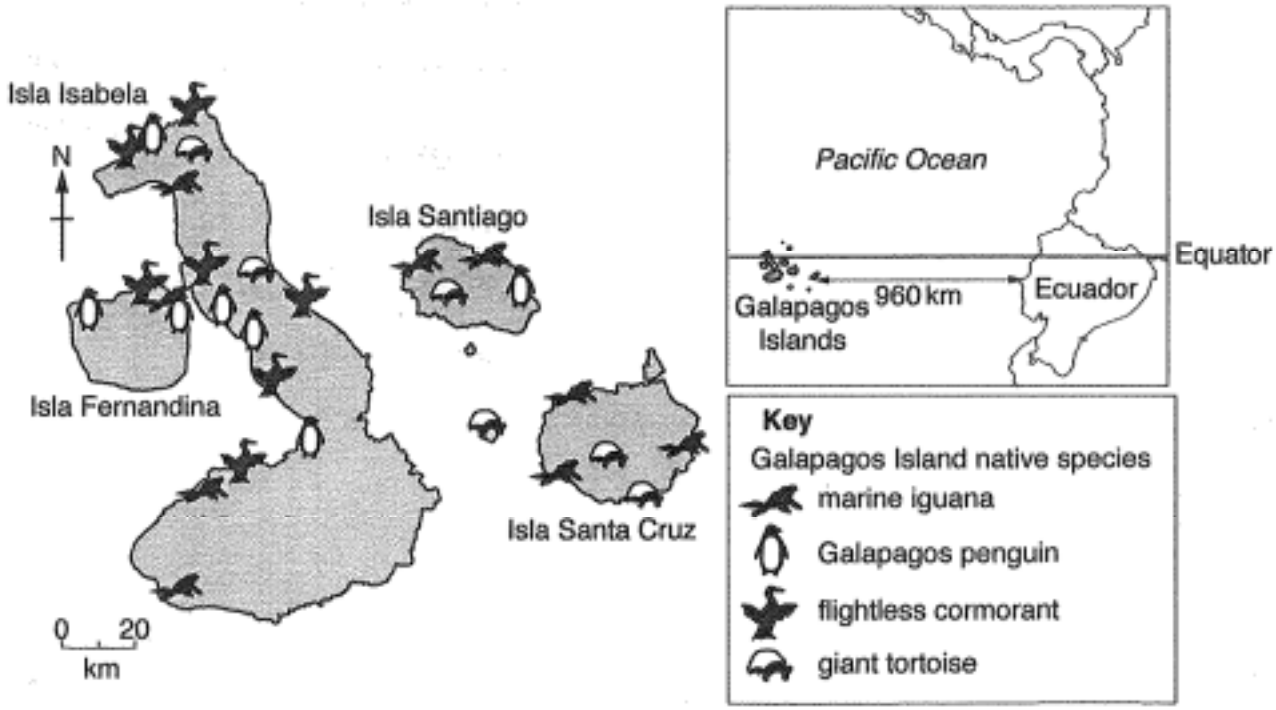
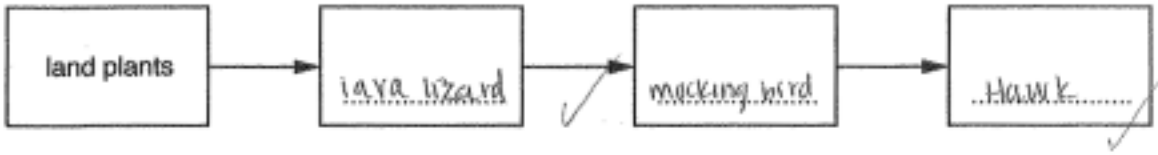


Fig. 2.2

Example candidate response – middle, continued

(i) With reference to Fig. 2.1, complete the four-stage food chain.



[2]

(ii) With reference to Fig. 2.1 and Fig. 2.2, explain how the terms *habitat* and *niche* can be applied to the location of species in the Galapagos Islands.

habitat ...is the general area with certain biotic and abiotic factors that make up the certain area.

niche ...is a specific place where an animal will live. An example would be how a penguin will only find a marine iguana in the very south part of Isabela and the other more native species will not be found down in that area.

[4]

(iii) A marine reserve has been established with a 64 km radius around the islands. With reference to Fig. 2.1 and Fig. 2.2, explain the need to conserve the Galapagos Islands' habitats **and** protect their coastal waters.

Since the Galapagos is so secluded it is very important to conserve the area because the animals do not have any where else to go. They have to either evolve or die off. They only have one of two primary producers so if the land or water one is damage it will have a very quick effect on the secondary consumers because they will not have any thing to get energy from.

[4]

(b) (i) Suggest **one** way in which tourism can pose a threat to the species in the Galapagos Islands.

Tourism brings in pollution and pollution could have a very negative effect on the species such as animals eating garbage that is left behind from humans.

[2]

Example candidate response – middle, continued

(ii) Fig. 2.3 shows the Galapagos Island of Santa Cruz. Describe how the strategy shown in Fig. 2.3 can protect the island's most vulnerable species.

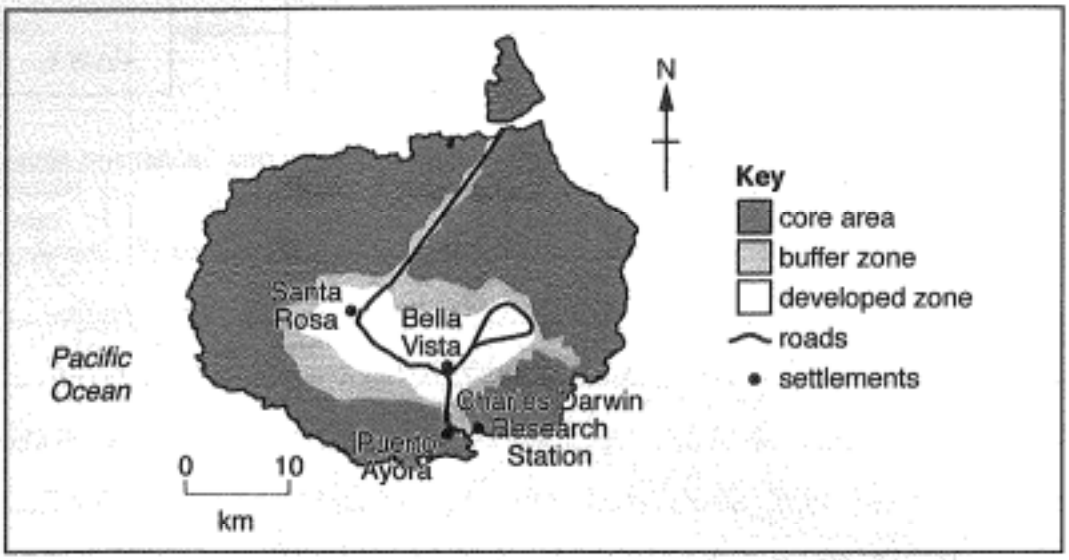


Fig. 2.3

This strategy can protect because they made their developed zone very concentrated within an area. They made it so there is only two entrances and made it a straight shot so that they would use as little land as possible. They also made sure that all of the development and structures stayed within the buffer zone and they left the surrounding area alone. This strategy is going to make it so the species and humans are not going to interfere with one another. They left plenty of untouched land that is going to allow the vulnerable species to live without being in humans way of humans. The humans also gave species a big enough buffer zone to keep them out of the developed zone.

[8]

[Total: 20]

Examiner comment – middle

2(a) (i). Two marks awarded for correctly linking the organisms in the food chain using Fig. 2.1.

Mark awarded = 2out of 2

(ii) The candidate has given a vague explanation and has referred to aspects of the biotic and abiotic environment, a specific place where an animal lives, and has used an example. However, the difference between habitat and niche is unclear.

Mark awarded = 2 out of 4

(iii) This candidate has made a vague reference to the species but there is no explanation as to why the species might die off, no threat to the species or damage to the environment.

Mark awarded = 0 out of 4

2(b) (i) The candidate has suggested litter pollution as a threat and as explained how this can directly affect the species.

Mark awarded = 2 out of 2

2(b) (ii) This answer meets the criteria for the top of the middle level, five marks were awarded. There is reference to all zones and most are developed in some way with some detail relating to size of area and position and the degree of interference from human activity. The information is organised and shows an adequate understanding.

Mark awarded = 5 out of 8

Total mark awarded = 11 out of 20

Example candidate response – low

2 (a) Fig. 2.1 shows a food web for some of the organisms living on part of the Galapagos Islands. Fig. 2.2 shows the locations of some native species on the islands.

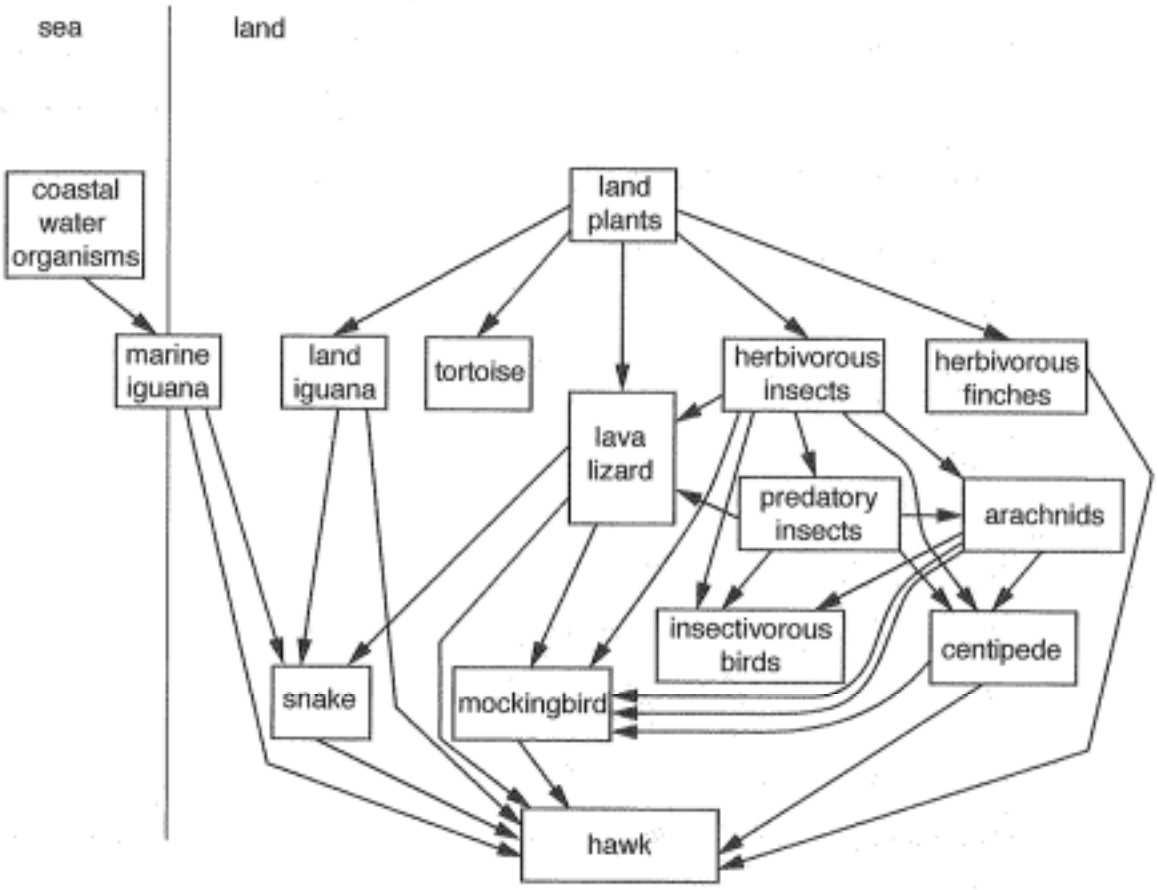


Fig. 2.1

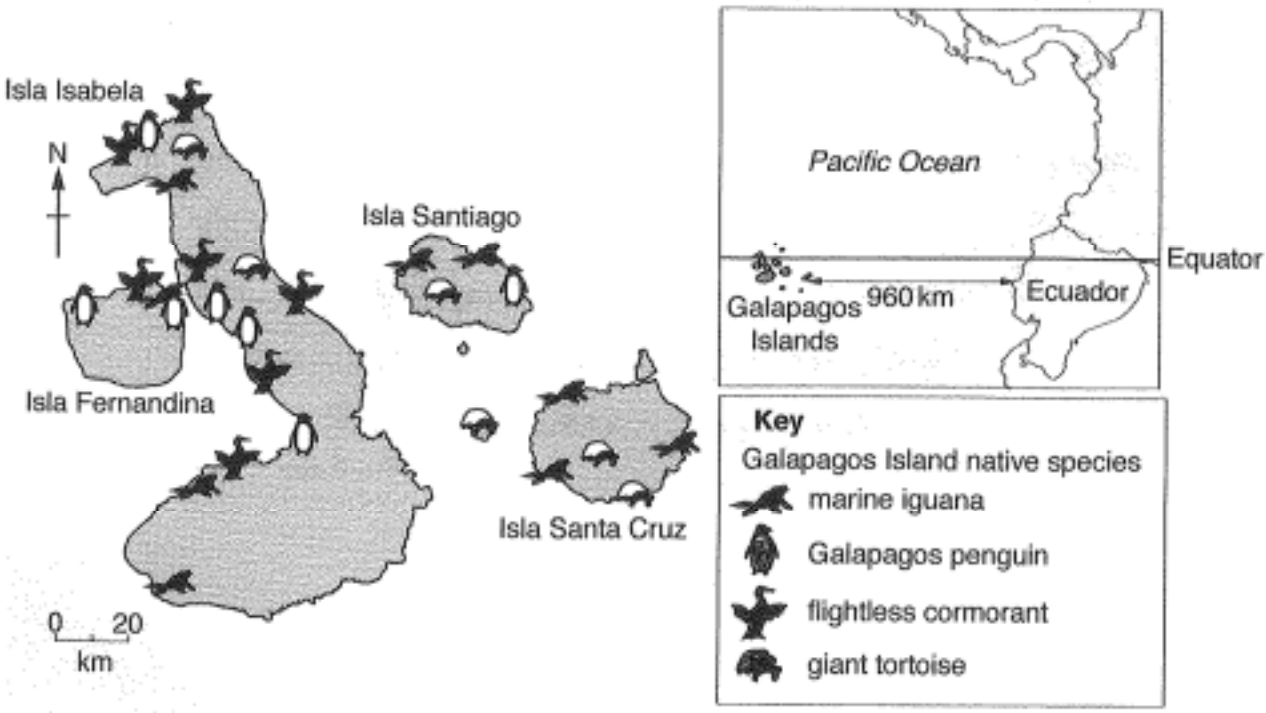


Fig. 2.2

Example candidate response – low, continued

(i) With reference to Fig. 2.1, complete the four-stage food chain.

land plants → Primary Consumer → Secondary consumer → Tertiary consumer [2]

0 ✓

(ii) With reference to Fig. 2.1 and Fig. 2.2, explain how the terms *habitat* and *niche* can be applied to the location of species in the Galapagos Islands.

habitat The habitat at the islands are all mostly different some could be sandy and flat while the other is rocky & steep

niche Every island has a certain sub group that fits together. Without a niche group species wouldn't be able to strive and to grow in size and adaptation. Animals learn over time how to adapt to other species and area, giving them a better chance for survival.

0 ✓

[4]

(iii) A marine reserve has been established with a 64 km radius around the islands. With reference to Fig. 2.1 and Fig. 2.2, explain the need to conserve the Galapagos Islands' habitats **and** protect their coastal waters.

The Galapagos Islands are extremely diverse. Many animals have been living in peace for many years. But if we didn't conserve the islands, all the animals could be dead/gone for good. The coastal waters hold drops there and if we were to destroy the water, people and plants will die along with many animals.

1 ✓

[4]

(b) (i) Suggest **one** way in which tourism can pose a threat to the species in the Galapagos Islands.

As tourists begin to come onto the islands all of the foods, trash, bottles, etc. can be tossed off or just left. Therefore many animals that eat it can get sick or even choke to death because of the litter left. [2]

2 ✓

Example candidate response – low, continued

(ii) Fig. 2.3 shows the Galapagos Island of Santa Cruz. Describe how the strategy shown in Fig. 2.3 can protect the island's most vulnerable species.

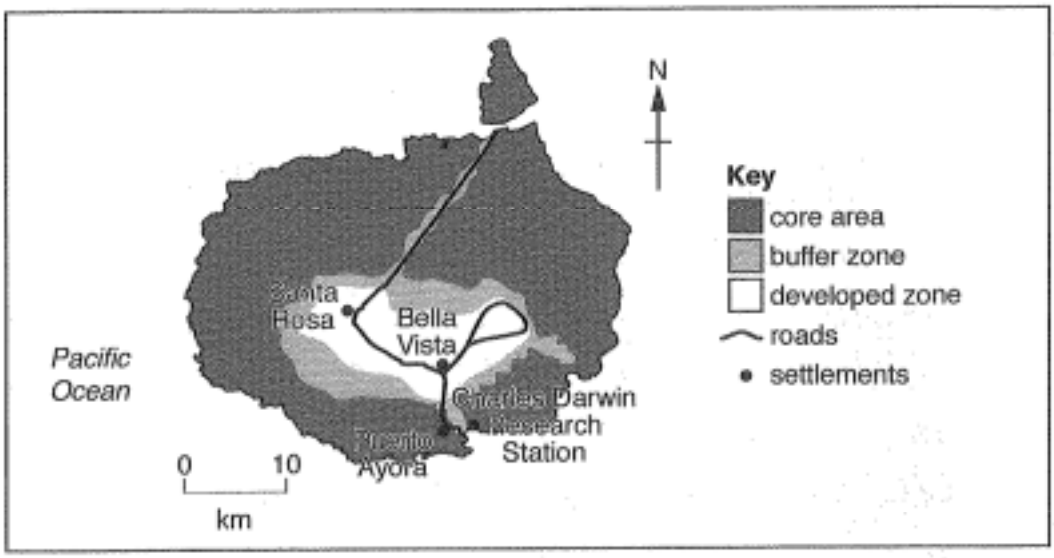


Fig. 2.3

Most of the island is coverd with protected area. The less human-environ interaction that occurs, the less animals are harmed. The road cuts through the (centre) of the island, leaving all the extra sides open to grow and thrive without touch of humans. The part of the area that is developed only a (small part) of the buffer zone. Visitors are allowing ~~[illegible]~~ minimal contact with any species that are in danger with only four settlements. It make it easier to get from place to place. Thus, limiting the roads that would expand the buffer zone further.

4

7

[8]

[Total: 20]

Examiner comment – low

2(a) (i). Although the candidate has used terms relating to each trophic level, this does not give an example of a food chain to show the feeding relationships between organisms involved at each trophic level and there is no use of Fig 2.1, which begins with land plants.

Mark awarded = 0 out of 2

(ii) The candidate has made no reference to organisms/species living in the different locations and there is there is no clear link to niche.

Mark awarded = 0 out of 4

(iii) The candidate has suggested that extinction of species could result from ships in the coastal waters. This is a limited explanation as there is no example and specific indication of the effect of marine pollution on the coastal waters, organisms or the food web.

Mark awarded = 1 out of 4

2(b) (i) Two marks were awarded for an example of human activity with a direct effect upon the species.

Mark awarded = 2 out of 2

2(b) (ii) This answer meets the criteria for the middle level and 4 marks were awarded. The candidate has shown an adequate understanding of the question and has made some use of the information in Fig. 2.3. There are references to all zones and aspects of the strategy are described with the core as the largest area, with more of island available to the species and less human interference/interaction. The buffer and developed areas are described as smaller areas area located in the centre of the island.

Mark awarded = 4 out of 8

Total mark awarded =7 out of 20

Section B

Question 3

3 **(a)** Fig. 3.1 shows the number of threatened tree species in three categories for different regions.

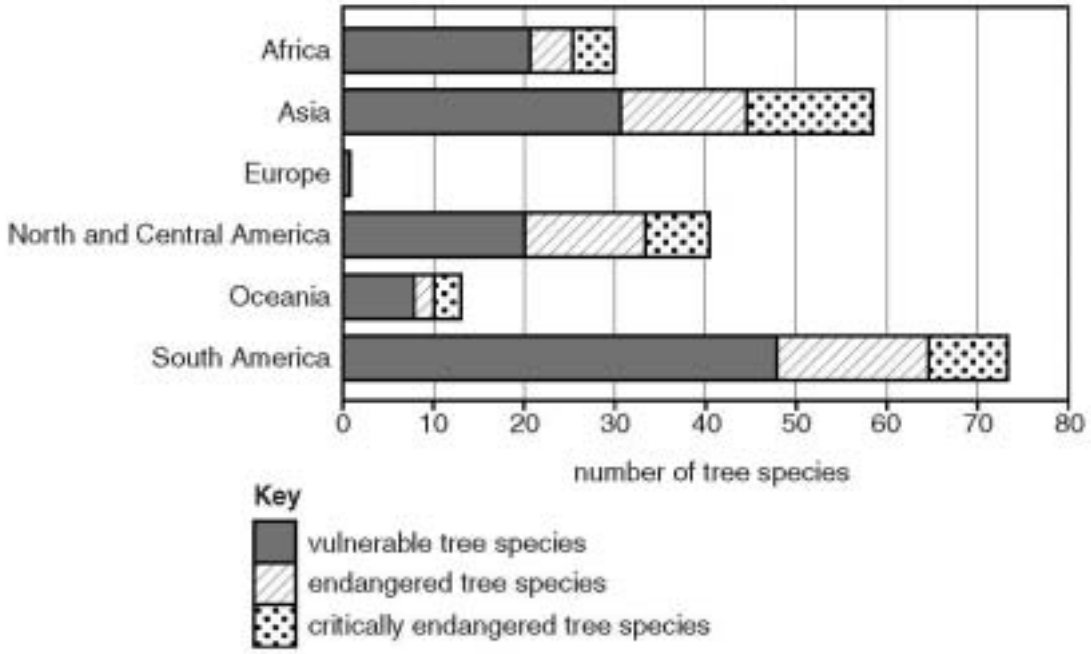


Fig. 3.1

Briefly describe the regional differences in the data shown in Fig. 3.1. [10]

(b) Using an example of a biome you have studied, describe the threat to both the extent and ecological quality of its forest ecosystems. Evaluate the measures that can be used to sustain the biodiversity of these forest ecosystems. [30]

[Total: 40]

Mark scheme

3 **(a)** A description of the regional differences in the data shown in Fig. 3.1 should include reference to the overall number of threatened species and the relative contributions from each of the three categories for most regions. Regions should be compared and contrasted, for example: South America has the most overall threatened tree species with more than 70% and the largest percentages of both vulnerable and endangered species. Europe has the lowest overall percentage of threatened species with less than 2% but only in one category (vulnerable). Asia has the largest percentage of critically endangered species, approximately 15%. Approximately half of all threatened species are in the endangered and critically endangered categories in both Asia and North / Central America.

A balanced answer is achieved by reference to most regions, all threatened categories and supported with data from Fig. 3.1.

Please use level descriptors 1

[10]

(b) *The question requirements are:*

- *to describe the threats to the ecological quality and extent of forests*
- *to describe the measures that can be used to manage forest ecosystems*
- *to evaluate the measures*
- *to select and use examples of forest ecosystems from one biome*

Indicative content:

Threats to the extent of the forest result from the destruction of large areas of forest for agriculture, cattle ranching, mining, urban development, infrastructure development and the demand for fuel-wood and timber. Ecological quality of forests is threatened by afforestation, the use of monoculture, planting non-native exotic species and the fragmentation of forest areas. Climate change will impact both upon the extent and ecological quality of forests. Measures include, for example, the establishment of protected areas, forest reserves and conservation. Sustainable practices include for example: forest regeneration, reforestation, sustainable wood extraction, selective logging, agroforestry, terracing, soil conservation, plantations, ecotourism, sustainable agriculture, practical small-scale initiatives, and the use of alternative non-wood products.

Please use level descriptors 2

[30]

Example candidate response – high

Within all areas there are vulnerable tree species. Most also have endangered and critically endangered species, eahs Europe due to their lacking overall of tree species. Europe has less than five threatened species according to figure 3.1, which means that they can focus on these and keep them from being completely extinguished. Areas such as Asia and South America have many vulnerable tree species partly due to their biodiversity as a whole. These areas contain biomes of maor tree biodiversity which contribute to their large number in danger.

Central & North America have a more moderate stance with 20 species vulnerable & about 20 endangered or critically endangered. Africa has about the same number of vulnerable species, however only ten endangered/ critically dangered.

Oceania, like Europe has few trees therefore few ~~endan~~ in trouble overall.

One biome in trouble is the deciduous forest biome. This biome is threatened by ~~the~~ the growing population of the people which inhabit/ surround it

Example candidate response – high, continued

in places like North America. This affects the deciduous forest by ~~making~~ in two ways: agriculture and development.

Unsustainable agricuture practices are such as monocropping, clear cutting, and chemical fertilizers / pesticides rob the ecosystems soil of nutrients and destroy many animals habitats. This can be corrected by using smaller-scale, less industrialized practices. Examples of this include agroforestry, or planting many species around trees so that the soil/ecosystem maintains its diversity and nutrients. This also helps the plants flourish since the presence of trees & their roots prevent erosion. Also, planting many species in one field virtually illimirates the need for pesticides which harm the surrounding water sources & animals. These pectisides lower the quality of the ecosystem.

The growing population not only affects the agriculture business within the deciduous forest, but also the urbanization of these lands. Urbanization leads to clear-cutting, and the need for energy; both of which lowers the extent of this biome, and it's quality. Solutions can be found in sustainable practices much like in agricuture.

Example candidate response – high, continued

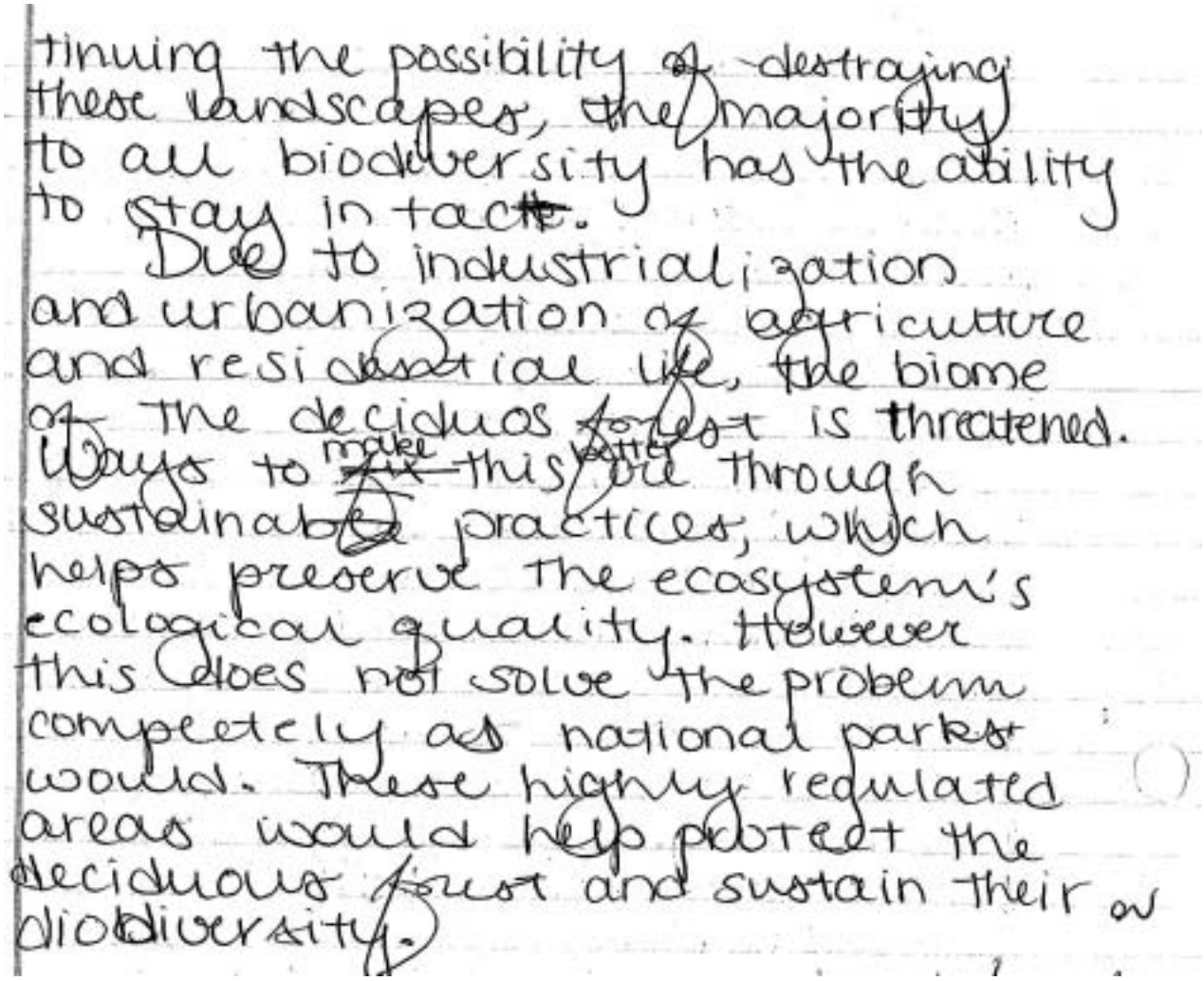
instead of completely clear cutting land & using the trees for the logging industry or making room for homes, companies could selective cutt and still leave some trees in tact and usable for habitats & for animals. Alternative energy sources could also be used, such as solar, thermal and wind energy rather than destroying the deciduous forest landscape with fossil fuel extraction.

Although sustainable residential and agriculture does slightly help the ecological quality of the biome, they only slightly help the problem of extention of this biome. However national parks public land usage can help this problem.

~~To define public lands in this answer,~~

Deciduos forests contain vast biodiversity due to their seasonal climate and moderate to high precipitation rate. They also contain vast landscapes which would be damaged by any agricultural or residential use. This proves why ~~natural pa~~ national parks, wildlife preservations and other public lands would help preserve both the extent and ecological quality of this biome. By having many regulations and discon-

Example candidate response – high, continued


tinuing the possibility of destroying these landscapes, the majority to all biodiversity has the ability to stay in tact.
Due to industrialization and urbanization of agriculture and residential life, the biome of the deciduos forest is threatened. Ways to make this better through sustainable practices, which helps preserve the ecosystem's ecological quality. However this does not solve the probem competely as national parks would. These highly regulated areas would help protect the deciduous forest and sustain their biodiversity.

Examiner comment – high

3(a) In this answer the candidate has supported a detailed description of the regional differences with numerical data from Fig 3.1 and refers to most regions and all categories, taking into account the relative proportions in the three categories. The answer shows a good understanding of the question and shows good use of data and information provided.

Mark awarded = 8 out of 10

3(b) This candidate has selected the deciduous forest biome as a biome and has given a good and detailed description of threats from increased agricultural development and unsustainable agricultural practices leading to a decline in soil fertility and habitat destruction. Measures such as agroforestry, multiple cropping, selective cutting and the establishment of national parks/wildlife areas are developed although there are no examples. The candidate refers to both extent and ecological quality of the areas. The essay is balanced between the threats to the forest ecosystems and measures which can be employed supported by effective evaluation and good use of relevant vocabulary.

Mark awarded = 27 out of 30

Total mark awarded = 35 out of 40

Example candidate response – middle

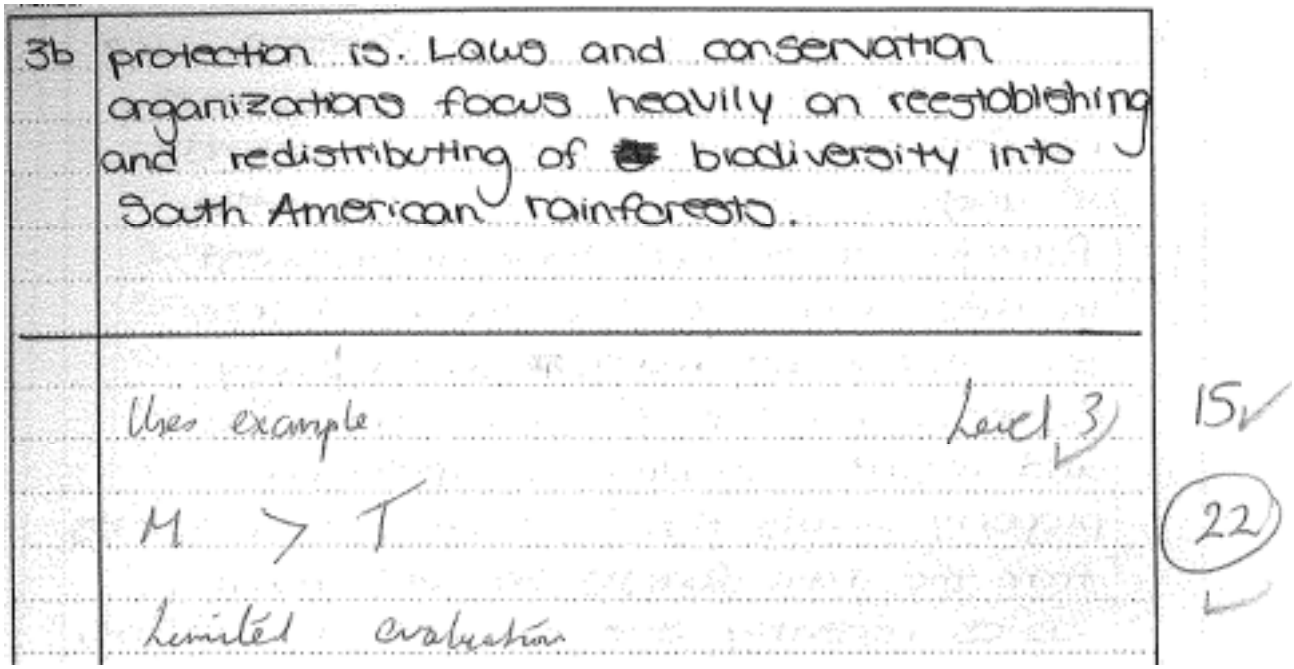
3a As illustrated in the Figure 3.1 the areas with the most vunerable or endangered tree species are [redacted] areas with various biomes. For example Africa is home to deserts, rain forests, and swampy wetlands. Africa also shows signs of having all three stages of vunerable, endangered, and critically endangered tree species. South America is famous for rain forests with thickly grown vegetation, yet South America has the greatest section of vunerable and endangered tree species. Europe, on the other hand, shows to have a (significantly small portion) of just vunerable species. Unlike the other areas Europe is the oldest area to be developed. Europe was mostly developed by the time Asia or Africa were uprising in the industrial world. Having the lowest tree species count automatically results in the least likely to be endangered. Also Europe is mostly consisted of MEDCs who fund conservation and prevention, unlike an LEDC such as Africa.

no data

Example candidate response – middle, continued

3b South American rainforests are most known for having prosperous rainfall and being home to thousands of varying species. Unfortunately other foreign forces have took an interest in these rain forests. Endangered tree species are becoming increasingly deforested due to mining companies and business' looking for appealing property. Locals thrive off of the resources from the rain forests but are having issues recently due to loss of habitat. Destruction of these forests not only threaten local villages, but the loss of diodiversity proves that redemption is unlikely. Conservation organizations such as WWF and CITIES come together in attempt to persuade South American government to develop laws to protect the forests. These laws enforce the importance of prevention to the public and gives succession time to regrow and welcome back new and vunerable species. Tourism is also encouraged in areas like South American rain forests to open the public eye to the beauty of this biome. Education of the local and foreign public creates the desire to help. Hiking and guided tours allow the public to take note of how important

Example candidate response – middle, continued



Examiner comment – middle

3(a) In this answer the candidate has considered three regions in detail in order to provide a detailed description of the regional differences. All three categories are mentioned and there is some idea of differences in the individual categories and some idea of relative proportions, with the largest section of vulnerable in South America compared to the endangered and critically endangered categories and to Europe having only vulnerable species. The candidate has made good use of the information but the description is not supported with numerical data from Fig. 3.1.

Mark awarded = 7 out of 10

3(b) The candidate has selected the rainforest biome and has briefly described the destruction of the forest due to mining and deforestation for land development together with threats to habitats and biodiversity. There is reference to the work of conservation groups, legislation, creating awareness through education ecotourism and the involvement of the local community on conservation as measures and some understanding of the content required. The candidate was awarded a Level 3, as there is some imbalance of the content with more detail on the measures than threats and there is limited evaluation.

Mark awarded = 15 out of 30

Total mark awarded = 22 out of 40

Example candidate response – low

With the exception of North and Central America, ~~countries~~ Continents that have higher economic development usually have lower endangered, and vulnerable species. South America for example is a continent with many low economic developed countries and a large amount of forrests. The countries have lower restrictions on deforestation then more developed ~~ones~~ ones. The people will cut down forrests for fuel, furniture, housing, agriculture, and economic gains. When a large population of people live in poverty, conservation of habitats or species usually aren't the main focus, if a focus at all, in lower economic developed countries. Most countries in Africa, Asia, and south America are ~~total~~ less economically developed, this is why their number of tree species that are vulnerable, endangered, and critically endangered are so high.

The tropicall rainforrest can be found on the continents of Africa, Asia, central america, and south America. I will be specifically talking about the one in South America. The major problem here is deforrestation. Defforestation does not just effect the trees that have been cut down, but also all of the organisms that lived in the area before the trees were cut down cutting

Example candidate response – low, continued

down trees is a noisy process. This causes noise pollution and actually drives animals away not only in the area being cut down but also in the surrounding areas. This causes the health of the ecosystem to fall. If the people who cut down the trees are using large equipment or the slash and burn method air pollution can take place effect, causing the health to drop even further. The only way to combat this is to decrease the amount of trees being cut down and replant trees in areas that have been cut down. If it is efficient enough more trees will be planted than cut down which would help the ecosystem become healthier and larger.

Examiner comment – low

3(a) In this answer the candidate refers to regions and categories and therefore shows some use of the information provided but there is no data from Fig 3.1.to support the discussion. The candidate considers regions as two broad groups the first including Africa, Asia and South America with more threatened species in all categories and fewer restrictions on deforestation compared to the other regions with higher economic development and with lower numbers of threatened species in the endangered and vulnerable categories. However, there is no contrast in the relative proportions in each category for different regions. The answer demonstrates an adequate understanding of the question.

Mark awarded = 5 out of 10

3(b) The candidate has stated the type of biome as tropical rainforest with a brief description of the distribution. Some threats from deforestation and pollution are outlined and measures to reduce deforestation and carry out afforestation are mentioned but there is no detail, the answer contains limited understanding of the content required and only contains a simple evaluative statement. The essay is poorly balanced between threats and measures with limited evaluation.

Mark awarded = 12 out of 20

Total mark awarded = 17 out of 40

Question 4

4 **(a)** Fig. 4.1 shows a lake which is enriched with nutrients in **A** and has subsequently suffered from the effects of eutrophication in **B**.

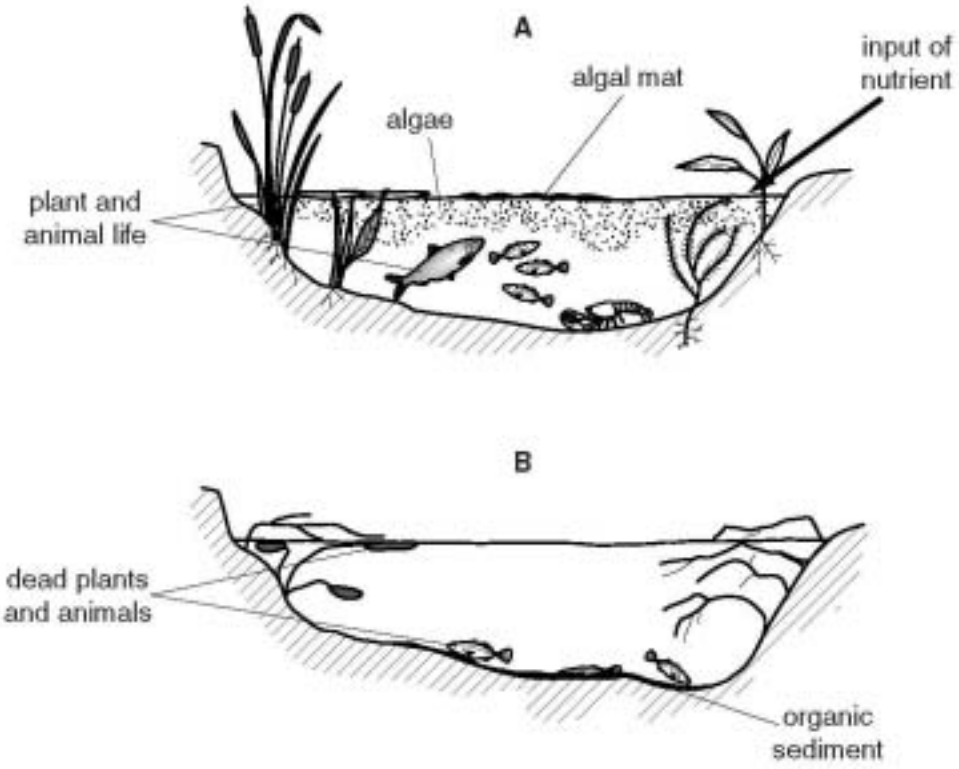


Fig. 4.1

With reference to Fig. 4.1, describe the process of eutrophication and its effects. [10]

(b) Describe the sources of nutrient enrichment of rivers and lakes. For a river with which you are familiar, evaluate the measures that have been used to prevent or reduce pollution. [30]

[Total: 40]

Mark scheme

4 **(a)** An answer should sequence the process of eutrophication and refer to the indicators shown in Fig. 4.1 A, for example: the enrichment of the water due to an enhanced input of nutrient and the increased growth of algae to form an algae bloom / mat. As a result of light being blocked from the plants in the water, they are unable to photosynthesise and die. This leads to decomposition of the dead plants and algae, and a build-up of organic sediment as shown in Fig. 4.1 B. An increase in the population of decomposers depletes the oxygen supply in the water leading to the death of fish and other aquatic organisms, including invertebrates. The effect upon the community of organisms and biodiversity of the ecosystem should be considered.

A balanced answer requires both process and effects and reference to Fig. 4.1.

Please use level descriptors 1

[10]

(b) *The question requirements are:*

- *to describe sources of nutrient enrichment*
- *to suggest measures to prevent and to reduce river / lake pollution*
- *to evaluate the management strategies*
- *to select and use an example of a river*

Indicative content:

Sources include, for example, fertilisers from agricultural run-off, detergents from domestic waste, sewage, animal waste from farms. Measures include for example local and regional policies, waste management, sewage treatment works, agricultural policies including controlling the use and timing of fertiliser treatments and public awareness of pollution. Both sources and measures should be linked to the specific example of a river.

Please use level descriptors 2

[30]

Example candidate response – high

Section B

4 a) Eutrophication begins with the ~~extra~~ input of nutrients into a body of water as indicated by the arrow in A in Fig 4.1. ~~These with~~ Algae in the water utilize the nutrients and grow larger, forming algal blooms. The algal blooms can grow so large that they form an algal mat on or near the surface (shown in Fig 4.1) which blocks sunlight from penetrating to the bottom, reducing or even stopping plants from photosynthesizing. This reduces the amount of oxygen in the water. At the same time, increased amounts of algae means more food for bacteria in the water. The bacteria grow in populations and break down the abundant algae, respirating in the process. Increased populations of frequently/heavily respirating bacteria remove a great deal of oxygen and replace it with carbon dioxide. B shows the effects of the depleted oxygen supply and blocked sunlight; plants cannot photosynthesize so they die, and the animals can neither breathe nor consume the plants so they die as well, and the dead organisms form a layer of organic sediment on the floor as they decompose. The removal of oxygen past the point of livability turns the body of water into what are called dead zones because no life can survive in the oxygen-depleted waters.

10

b) Rivers and lakes can receive the input of nutrients naturally, as eutrophication is a natural process, and

Example candidate response – high, continued

this usually comes from the decomposition of organisms which returns nutrients like nitrogen and phosphorous to the soil and water. The input of nutrients can also be caused by humans who typically speed up the process of eutrophication which is then referred to as cultural eutrophication which happens too quickly and poses a threat to the longevity of ecosystems and species. Many fertilizers used for agriculture include nitrates and/or phosphates. The ~~that~~ irrigation water becomes contaminated with these compounds when it is used and inputs the nutrients to bodies of water when it reaches them through runoff or seeping through the ground. In addition, many factories produce waste or waste water which contains such nutrients, and this water can also find its way to a river or lake. Large feedlots produce great amounts of animal waste which also contain these nutrients and may enter the soil or be carried off by precipitation to add to the input of nutrients in the river or lake. Animal waste as a source of nutrients can also be a natural source where it occurs in fewer numbers when compared to mass animal farming conducted by humans.

One river ~~+~~ which has undergone issues related to pollution is the ~~Colorado~~ Mississippi River in the United States. There are a great deal of farms along the coast of the river, so it receives a large input of nutrients from several states through which it runs. The river ends in the Gulf of Mexico, and the bay it exits in

Example candidate response – high, continued

Louisiana is considered a dead zone as a result of eutrophication from the input of so many nutrient-rich fertilizers. In order to reduce the impact of this pollution, states containing or bordering the Mississippi pass regulations to reduce fertilizer use or to encourage the use of nitrogen- and phosphate-free fertilizers in agriculture. Restrictions may also be placed on factory production, limiting production or the amount of dumping deemed admissable. Efforts are also in place to clean the river water which is already polluted by altering the river to make it flow faster in some areas because faster flowing water removes pollutants better than slow-flowing, or adding rocks to add as filters for the water. The dead zone in Louisiana may be attempted to rectify by removing some algal blooms and adding oxygen to the water. Placing restrictions on businesses can only be effective if they are properly enforced, and money bribes often see that they are not. Cleaning the river where it is polluted now may not stop it from becoming polluted again. Perhaps the best measure to prevent/reduce pollution would be very strict regulations/limitations on farms and factories with the absolutely imperative addition of strict enforcement of these new rules.

Balanced essay with assessment, development & evaluation ✓L1

25 25 35 (35)

Examiner comment – high

4(a) The candidate has provided an answer with a logical sequence which shows a very good understanding of the question and very good balance between the process of eutrophication and the effects. The candidate was awarded 10 marks. There is very good use of the information in Fig. 4.1 with reference to the input of nutrients and the growth of algae. The candidate has mentioned the effect upon the process of photosynthesis by aquatic plants and has described decomposition by the bacteria and the depletion of oxygen in the water.

Mark awarded = 10 out of 10

4(b) The candidate has described in detail the sources of nutrient enrichment including nutrients from decomposition, enhanced enrichment as a result of human activity from the input fertilisers from agriculture, organic pollution from animal waste and waste water from factories. The candidate has given a variety of pertinent measures specifically linked to the example of the river and the specific problem sources. This answer fulfils all the requirements of the question for level one with a balance of detail on sources and a range of measures considered together with some evaluation of the measures.

Mark awarded = 25 out of 30

Total mark awarded = 35 out of 40

Example candidate response – middle

Natural eutrophication - is the natural enrichment of nutrients such as nitrates, and phosphates, and O_2 in a lake or pond, by the plants growing along the edge of the lake or pond the effects result in a healthy ecosystem since there is no abundance of one or more nutrients which does not create a algal mat that covers the surface of the lake or pond using up all the nutrients and blocking sunlight for other aquatic plants.

Cultural eutrophication - Which is the type of eutrophication seen in figure 4.1, is the excessive amount of enrichment of nutrients such as nitrates and phosphates from fertilizers from lawns which is washed up from runoff and deposited into a lake or pond. The effects of cultural eutrophication are detrimental in the health of the ecosystem. The abundance of nutrients such as nitrates and phosphates create a algal bloom or algal mat which block sunlight for other aquatic plants resulting in the death of those plants, as well as bacteria living in the pond or lake increase the amount of dissolved oxygen in the pond or lake which fish living in the pond or lake cannot use depleted oxygen and as a result die.

Example candidate response – middle, continued

Sources of nutrient enrichment of rivers and lakes are run-off that carries nutrients such as nitrates and phosphates picked up and are washed into the lake or pond through a sewer system. Sewage system containing nitrates from feces drain into a lake or pond river. Waste from ~~Industries~~ containing nutrients such as phosphates and nitrates drain into a lake or river through an effluent ~~effulent~~ pipe. The St. Johns river located in Florida have struggled for many years in the amount of pollution being drained into the river. Some measures that are in place to reduce the amount of pollution entering the St. Johns are the capping or closing of ~~effulent pipes~~ effluent pipes that drain waste like toxic chemicals such as lead from Industries. Developing a sewage treatment plant that treates and cleans water from harmful waste such as harmful bacteria, before draining that water back into the St. Johns. Florida residents use less fertilizer in their lawns reducing the amount of ~~run~~ nutrients such as phosphates and nitrates that enter the St. Johns through run-off of water through sewer pipes. Fix leaking pipes that leak harmful chemicals such as chlorine and harmful waste such as bacteria into the St. Johns.

Level 3✓

Lacks evaluation otherwise balanced 15✓

(24)

Examiner comment – middle

4(a) The candidate has accessed the top level in part **(a)** of the question. The reason for this is that they have provided an answer with good balance and that the answer covers both the process of eutrophication and the effects. There is good use of the information in Fig 4.1 with reference to the nutrient input and the forming of the algal mat. They have mentioned the effect of the algal in using up nutrients and blocking light from the aquatic plants below and this is clearly linked to the death of plants and increase in the bacteria in the water, with the effect being the depletion of oxygen in the water.

Mark awarded = 9 out of 10

4(b) The candidate has described some sources of nutrient enrichment, e.g. run-off from sewage, factory waste via effluent pipes and fertilisers but has not mentioned agriculture and domestic sources. There are some specific measures linked to the example of the river but there is no detail and no evaluation of measures. The candidate has shown some understanding of the content required and fulfilled some requirements of the question.

Mark awarded = 15 out of 30

Total mark awarded = 24 out of 40

Example candidate response – low

a Eutrophication is the input of algae and other nutrients into the fresh water ways. In figure 4.1, there is ~~an~~ a substantial amount of algae and an algeal mat present in the lake. As shown in part B, eutrophication can prove to be lethal to many aquatic plants and animals. The lake in part B of figure 4.1 now has a large deposit of organic sediment resting on the bed of the lake.

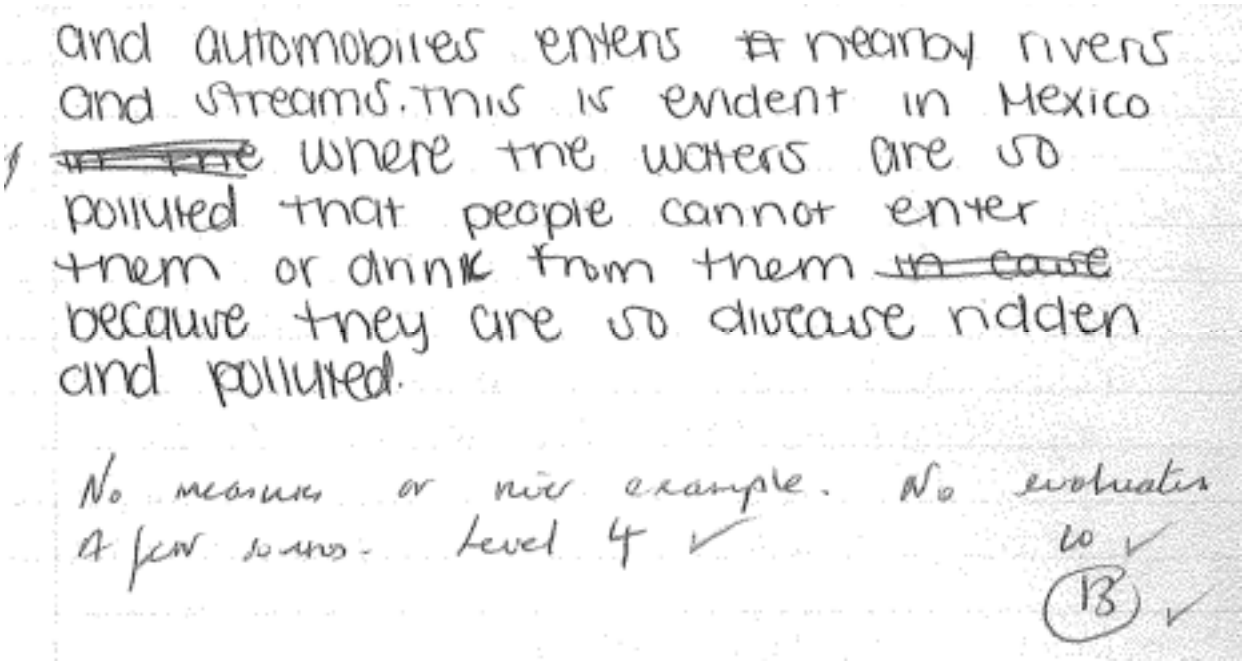
b Rivers and lakes recieve nutrients in many ways. This includes run off from agricultural farmlands and run off from urban areas. The breakdown of dead plants and animals also contributes to the enrichment of these rivers and lakes.

Fertilizers and machines (tractors, plows, etc) are commonly used on farmlands. While they may be beneficial for agricultural purposes, they also pose threats to our waterways. Nitrogen and carbon can easily enter the waters and cause algal blooms.

Deceased organisms in the water ways also add to the nutrients already present. Bacteria breakdown these organisms and release more nutrients into the fresh water.

Another form of runoff comes from urban and industrial areas. Pollution from factories

Example candidate response – low, continued


and automobiles enters nearby rivers and streams. This is evident in Mexico where the waters are so polluted that people cannot enter them or drink from them because they are so diseases ridden and polluted.

No measures or river example. No evaluation A few points. Level 4 ✓ 10 ✓ 13 ✓

Examiner comment – low

4(a) The candidate has given a limited description of the process and effects of eutrophication. There is some reference to the information in Fig. 4.1, the input of nutrients into the lake and the organic sediment and the candidate has considered the lethal effect of eutrophication on the aquatic plants and animals. However the answer contains errors, shows limited understanding of the process and effects of eutrophication and makes limited use of the information.

Mark awarded = 3 out of 10

4(b) The candidate has given a description of sources of and mentioned fertilisers, run-off from farmland and run-off from urban and industrial areas as well as natural sources of nutrients from the decay of dead organic material. However, the essay is very poorly balanced with only measures described and is lacking in evaluation. There is no example of a river and only to the country of Mexico. This essay contains limited understanding of the content required, fulfils limited requirements of the question and makes limited use of relevant vocabulary.

Mark awarded = 10 out of 30

Total mark awarded = 13 out of 40

Question 5

5 **(a)** Fig. 5.1 shows the net primary productivity (NPP) of ecosystems and agricultural land.

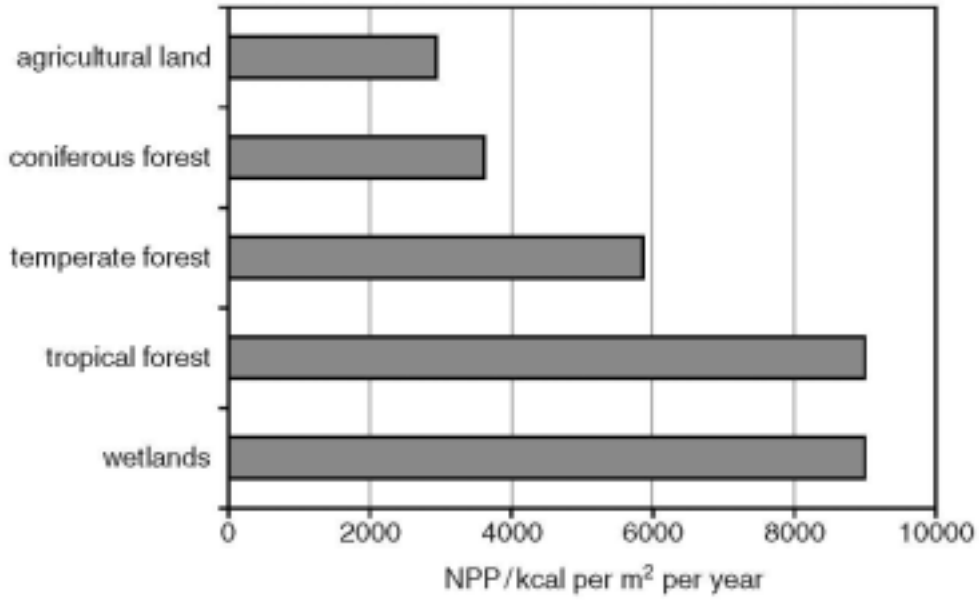


Fig. 5.1

With reference to the data in Fig. 5.1, outline **three** factors that affect the variations in primary productivity of ecosystems and agricultural land. [10]

(b) Fig. 5.2 shows the hectares of productive land and sea needed to resource the lifestyle of one person.

country	productive land and sea/ha
United States of America	9.6
Brazil	2.1
China	1.6
India	0.8

Fig. 5.2

Using examples of countries at different levels of economic development, assess the extent to which the sustainable use of resources can help to resolve issues arising from the increasing demands of populations. [30]

[Total: 40]

Mark scheme

5 **(a)** An answer should outline factors affecting net primary productivity of ecosystems including temperature, variation in light intensity, the availability of water due to precipitation and minerals from soil. The type and density of the vegetation may also be considered. Agricultural systems are included and may be compared to natural systems. There may be reference to variation in the productivity of agricultural systems as a result of human impact upon the land or increased primary productivity through the use of fertilisers and irrigation. There may be reference to the distribution of the major biomes.

A balanced answer will outline three factors and use data from Fig.5.1.

Please use level descriptors 1

[10]

(b) *The question requirements are:*

- *to express an understanding of the issues relating to the resource demands of a population*
- *to describe measures which allow the sustainable use of resources*
- *to evaluate the measures in terms of sustainability*
- *to select and use examples from MEDCs and LEDCs (countries at different levels of economic development)*

Indicative content:

Examples of countries at different levels of economic development are provided to compare the USA with Brazil, India and China. Answers need to demonstrate an understanding of how lifestyle, economic development and population growth can increase the demand for resources to an unsustainable level. The main focus of the essay should be on the methods which allow a more sustainable / more efficient use of resources and the careful management of resources to meet these growing demands; in order to reduce the environmental impact of the population, and keep the ecological footprint low. Achieving sustainability of resources (the supply of food and other raw materials and energy) through for example: agricultural improvements, genetic engineering, high-yielding crops, organic farming, H.E.P., other renewable resources, reducing waste, reusing and recycling. An assessment of how far countries can reduce the environmental impact of the population should be discussed.

Please use level descriptors 2

[30]

Example candidate response – high

5.

(a) One factor that affects the variations of primary productivity is sunlight or solar energy. The more sunlight available allows for more plants and primary producers to be sustained which falls into the next factor, water; water is a major source for primary producers to grow and live so if there is an optimum amount of water and sunlight, more plants or primary producers can grow and raise the net primary productivity. Another factor is soil, the better the quality of soil whether it be high amounts of nitrogen or phosphorus, the more nutrients available for primary producers to grow and be able to give energy and raise the NPP of ecosystems or agricultural land, whatever way the energy is used. Figure 5.1 demonstrates those factors as wetlands, tropical forests and temperate forests all receive more water than coniferous forests or agricultural land. As the amount of precipitation and sunlight available rises, the higher the NPP as wetlands

Example candidate response – high, continued

and tropical forests have the highest amounts of sunlight and water received. Soil is a necessity in all the ecosystems and agricultural land as all the forests and lands need soil for primary producers to receive the nutrients to grow, if only bare rock was present it is unlikely the NPP would be high. (About 9000 in total in both wetlands and tropical forests

b) Unrenewable resources are the major sources of energy in today's global energy market. The United States of America has a higher GDP than that of India for example, and consumes more resources according to Fig 5.2 as they need more hectares of productive land and sea for their lifestyle. This high consumption of water, food and energy thus lowers the amount of resources as ~~things~~ resources like fresh water supplies have dropped and leaves less water available globally so water will ultimately be handled by who has the most money and citizens in countries of lower levels of economic development have less money to buy more resources than countries like the

Example candidate response – high, continued

United states. Figure 5.2 conveys how the GDP is relative to the amount of resources needed to resource the lifestyle. India has a lower GDP than USA, Brazil and China thus have less money to buy resources. So for resources in competition Indians will have less money on average to be able to have such resources. So in countries like the United States, considering that energy, food and water is usually needed for the lifestyle of someone so a sustainable use of resources such as recycling and re using materials and resources lowers the decline of available resources as well as save the planet. In MEDC's like the United States, since consumption and need of resources is so high, more forests need to be cut, more energy is needed and more food needs to be made. Cutting down forests lowers biodiversity as the habitat of species is lost, and more carbon dioxide is released in the atmosphere. As more energy is needed to create energy and manufacture food, more greenhouse gases

Example candidate response – high, continued

are released into the atmosphere as more than 75% of the worlds energy comes from the burning of fossil fuels, as each person globally requires less productive land and sea, less fossil fuels need to be burned and less fish needs to be caught increasing biodiversity. Countries like India, China and Brazil are developing and are going through population growth and if a sustainable use of resources is kept or executed then more resources are available to the incoming population. Countries like ~~the~~ the United states require more land and sea due to excess in ~~con~~ consumption, the more money a person has the more available resources they could buy, ~~to~~ to reach the point where the resources are being brought exponentially past the point of survival, countries like India, people use enough land and sea to grow crops and produce food enough to survive. Sustainable alternatives could be drip irrigation for agriculture to save the amount of fresh water and

Example candidate response – high, continued

lower the demand of freshwater available, recycle and reuse products to lower the need of capturing new or obtaining new resources, or find alternative sources of energy. Burning fossil fuels induces and promotes the greenhouse effect and the poles have been melting, melting sea ice raises sea level and coastal areas will submerge leaving less land available for the current AND incoming population. Hydroelectricity, Wind power, and solar power is clean and sustainable as it is constant energy for the needs of any person, the only issue is the burning of fossil fuels is has a large infrastructure across the globe and having drip irrigation systems developed or built is expensive so most people will be discouraged and continue to use resources unsustainably. Deforestation has been a huge issue and using less trees and planting more would help resolve the issue of wood for the increasing demands of populations as the higher the population, the more wood needed for firewood, or homes or whatever the need.

Example candidate response – high, continued

A sustainable use of resources offers more resources for the incoming population, but considering the lack of regulation and enforcement or cost to regulate issues like water consumption, it is difficult to resolve such issues and thus more difficult to obtain such resources in countries of lesser levels of economic development as they have less money to buy resources thus consume less than those citizens in countries of higher economic development. Education of using less resources could help solve the issue for every person in an MEDC to use less, but some still may not listen and lower the amount of available resources to an increasing population who increases demand.

A good essay, consider causes & consider measures. ✓

Several countries used as example. ✓

Balance present. ✓ L1 25

L1 26

34

34

Examiner comment – high

5(a) Three factors affect net primary productivity – sunlight, water availability and nutrients are outlined. The candidate has used data and information from Fig. 5.1 effectively, with clear reference to different ecosystems having different amounts of water from precipitation and sunlight and hence different rates of primary productivity supported with comparative data for two ecosystems.

Mark awarded = 9 out of 10

5(b) The candidate has effectively described the over consumption of resources of food water and energy and the use of non-renewable energy and damage to the environment. The candidate suggests that this unsustainable overconsumption of resources, with negative environmental impact, can be tacked by recycling and reusing resources thus reducing demand upon resources and subsequently reducing the negative impact upon the environment. This is compared to economically developing countries where rapidly increasing populations rather than wasteful overconsumption requires the sustainable use of resources. Measures such as drip irrigation and alternative sources of energy are suggested. The essay has balance, includes examples and contains evaluative statements. The candidate has shown good understanding of the content and the essay fulfils all the requirements of the question.

Mark awarded = 25 out of 30

Total mark awarded = 34 out of 40

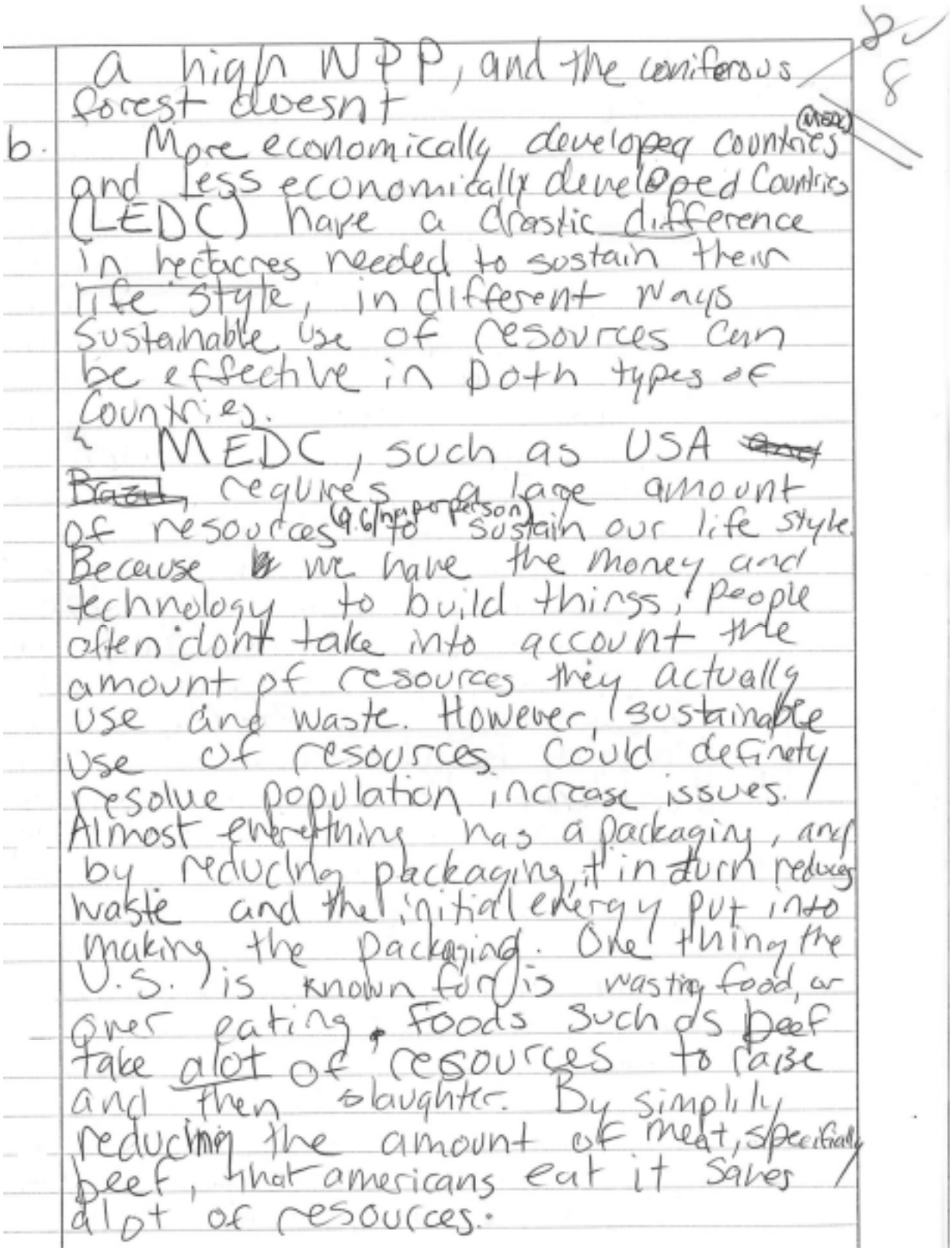
Example candidate response – middle

5 a One factor that affects Primary productivity is the amount of water available. In areas such as tropical rainforests, which recive a lot of rainfall, and wetlands which have constantly saturated soils, have a high NPP of about 9000kcal p/m² per year. In areas with less rain such as temperate and coniferous forests get on average 3500 to just under 6000 Kcal per m² per year. This is because organisims, especially plants need lots of water to grow and preform photosynthesis.

Another factor is temperature. Warmer temperatures increase plant productivity This is seen in tropical rainforests, which are located near the equator and recieve lots of direct sunlight, and have around a NPP of 9000 kcal per m² per year. Coniferous forests, however are located closer to the poles, and are cooler year round, so plants cant grow as much especially in the winters.

The last factor is nutrient availability ~~Agricultural land~~ coniferous forests have a low nutrient availibility and thereby a low NPP, however tropical rainforests also have very few nutrients in their soils, but only because there are so many organisms in competetion that they have designed to take up nutrients as fast as possible and store it. That is why they still have

Example candidate response – middle, continued

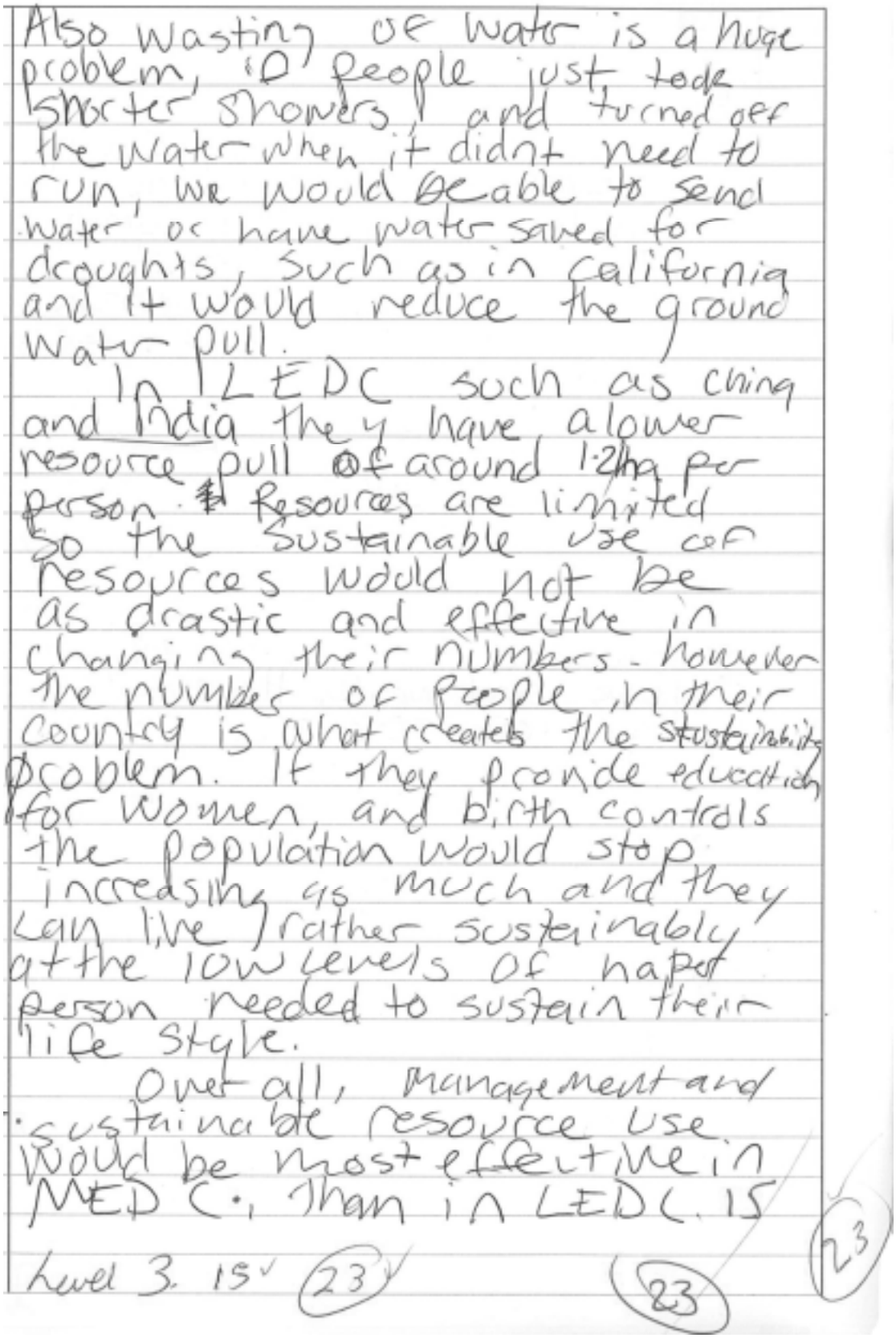


a high NPP, and the coniferous forest doesn't

b. More economically developed countries (MEDC) and less economically developed Countries (LEDC) have a drastic difference in hectacres needed to sustain their life style, in different ways Sustainable use of resources can be effective in both types of Countries.

MEDC, such as USA ~~Brazil~~ requires a large amount of resources (9.6 hectares per person) to sustain our life style. Because we have the money and technology to build things, people often dont take into account the amount of resources they actually use and waste. However, sustainable use of resources could definetly resolve population increase issues. Almost everything has a packaging, and by reducing packaging, it in turn reduces waste and the initial energy put into making the packaging. One thing the U.S. is known for is wasting food, or over eating. Foods such as beef take alot of resources to raise and then slaughter. By simply reducing the amount of meat, specifically beef, that americans eat it saves alot of resources.

Example candidate response – middle, continued



Also wasting of water is a huge problem, if people just took shorter showers, and turned off the water when it didn't need to run, we would be able to send water or have water saved for droughts, such as in California and it would reduce the ground water pull.

In LEDC such as China and India they have a lower resource pull of around 1.2ha per person. Resources are limited so the sustainable use of resources would not be as drastic and effective in changing their numbers - however the number of people in their country is what creates the sustainability problem. If they provide education for women, and birth controls the population would stop increasing as much and they can live rather sustainably at the low levels of ha per person needed to sustain their life style.

Overall, management and sustainable resource use would be most effective in MEDC's than in LEDC's. 15

Level 3. 15 ✓ 23 23 23

Examiner comment – middle

5(a) The candidate has outlined three factors affecting primary productivity- temperature, water and nutrients from soil and these are linked to photosynthesis. The answer shows a good understanding of the question. The candidate has made good use of the information provided to support their answer with examples of ecosystems which show differences in these factors, wetlands coniferous forest and tropical rainforest forest with comparative data for two ecosystems. The candidate was awarded 8 marks for a balanced answer covering three factors.

Mark awarded = 8 out of 10

5(b) The candidate has fulfilled some of the requirements of the question and shown some understanding of the content required. Some issues and some measures are included but issues are considered more than measures so there is some imbalance and there is more on the MEDC. The candidate has explained the waste of resources in MEDCs and has mentioned some environmental problems resulting from overconsumption but the sustainable use of resources is less well developed. This is compared to LEDCs where the issue of overpopulation and limited resources is discussed. There is some consideration of extent in evaluation with sustainable use of resources having greater impact in MEDCs.

Mark awarded = 15 out of 30

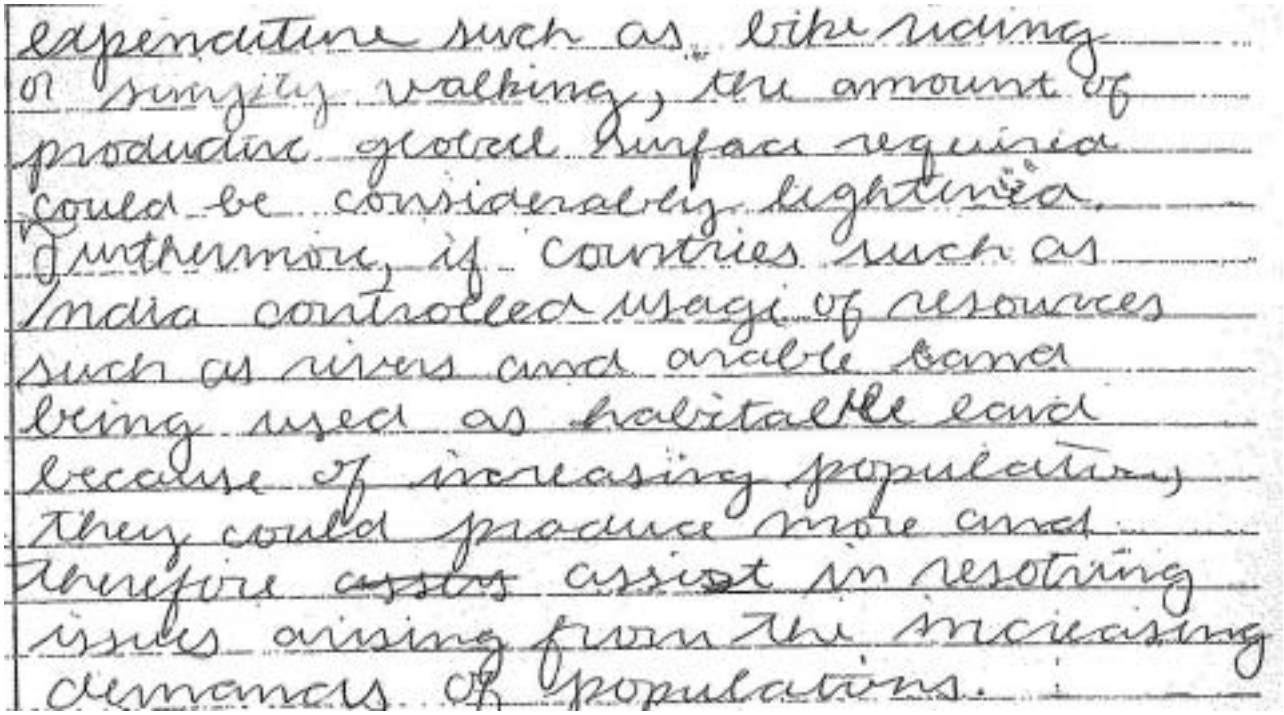
Total mark awarded = 23 out of 40

Example candidate response – low

Three factors that affect the variations in primary productivity of ecosystems and agricultural land are (water) access, because land with abundant access to water is likely to be more productive than one that must be watered; habitation, because whether or not plant life is being constantly depleted by herbivores will affect productivity; and urbanization, because if the land is located, for example, next to a freeway in the United States, pollutants which are unconducive to productivity are likely to present themselves.

The sustainable use of resources can help to resolve issues arising from the increasing demands of populations. For example, in the United States, each person requires 9.6 hectares of productive land and sea to support their lifestyles. However, if as a whole Americans made changes such as consciously using less generated energy/electricity, taking much shorter showers (and shortening all water usage), and engaging use of transportation not requiring energy

Example candidate response – low, continued


expenditure such as bike riding
or simply walking, the amount of
producing grazed surface required
could be considerably lightened.
Furthermore, if countries such as
India controlled usage of resources
such as rivers and arable land
being used as habitable land
because of increasing population,
they could produce more crops
therefore ~~assist~~ assist in resolving
issues arising from the increasing
demands of populations.

Examiner comment – low

5(a) The candidate has given a limited outline of only one factor (water) affecting primary productivity. There is some further discussion relating to human activity and mention of pollution negatively affecting primary productivity. There is limited understanding of the question and there is no use of the data or information in Fig. 5.1 and no examples of ecosystems.

Mark awarded = 3 out of 10

5(b) The candidate has provided a limited response to the question with a basic argument using some examples and there is some balance between the MEDCs and the LEDCs but with limited detail. The answer contains a limited understanding of the content required and there is no evaluation.

Mark awarded = 10 out of 30

Total mark awarded = 13 out of 40

Cambridge International Examinations
1 Hills Road, Cambridge, CB1 2EU, United Kingdom
tel: +44 1223 553554 fax: +44 1223 553558
email: info@cie.org.uk www.cie.org.uk