

Example Candidate Responses

Cambridge
International
AS Level

Cambridge International AS Level Environmental Management

8291

Paper 1: Lithosphere and Atmosphere

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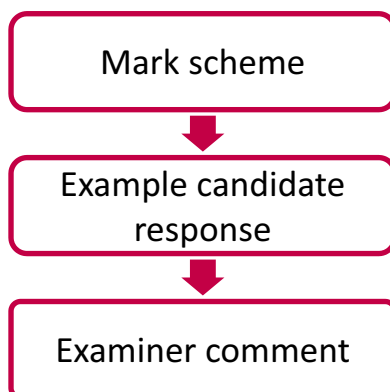
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Introduction

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 (high, middle and low) relate to the subject's curriculum and assessment objectives.

In this booklet a range of candidate responses has been chosen from Paper 1. 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 marks.

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 1: Lithosphere and Atmosphere

Section A

This consists of a variety of answers and candidates are required to answer all the questions. It is equal to half the available marks on the paper. It is important that candidates are familiar with the command words used in questions such as state, describe, assess, evaluate, etc.

Question 1

Mark scheme

- 1 (a) (i) Destructive / converging / convergent / subduction. [1]
- (ii) Subduction of one plate beneath another; leads to melting; less dense / volatile materials; rise to surface (along lines of weakness in crust); increasing pressure leads to eruption of volcano. [3]
- (iii) Eruptions are explosive; silica-rich magma and acidic lava; combine to produce viscous lava; moves slowly so it solidifies quickly. [2]
- (iv) Volcanic minerals; rapid weathering; leads to fertile soil; high agricultural yields; economic consequences; tourism; tradition. [2]
- (b) *Comparison of impact between the farmers and the city required.*
- Death; damage to the people; loss of livelihood; building damage; recognition of distance and / or time;
- Farmers on the slopes exposed to:
- lava bombs / lava flows / nuee ardente; less warning; greater density of ashfall / gas; leads to loss of crops and livelihood.
- Inhabitants of Yogyakarta exposed to:
- Wind-blown ash / lahars; more warning; lesser density of ashfall / gas; limited economic impact. [4]
- (c) Short term:
- LEDCs lack resources; to provide for rescue / first response; cannot afford early warning systems; poor infrastructure affects ability to respond; may require outside aid / NGOs; poor education impedes response; ORA for MEDCs.
- Long term:
- LEDCs lack capital for investment; for monitoring and early warning systems/named examples; for education systems; to establish evacuation and rescue plans; LEDCs less able to repair / rebuild / reconstruct. ORA for MEDCs
- Reserve one mark for correct reference to Table 1.1.* [8]

[Total: 20]

Example candidate response – high

- 1 (a) Look at Fig. 1.1 which shows the location of Java in south east Asia and an enlarged cross section of the plate boundary, labelled as line A to B.

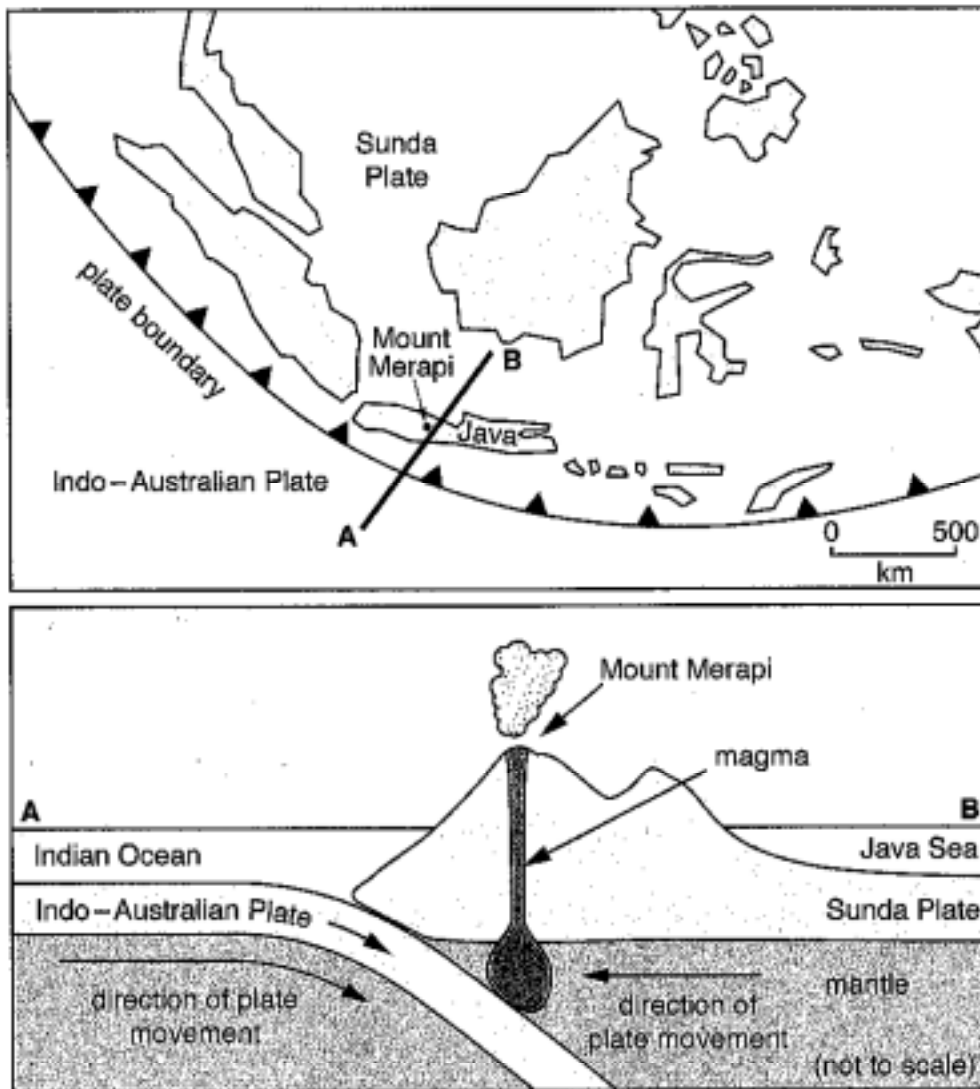


Fig. 1.1

- (i) State the type of plate boundary shown in Fig. 1.1.

.....convergent / destructive ✓✓..... [1]

Example candidate response – high, continued

- (ii) Explain the processes that cause volcanic eruptions along the plate boundary shown in Fig. 1.1.

The ^{Indo-Australian} oceanic plate is more dense, and is being pushed below the lighter ~~continental~~ Sunda plate. This causes ~~the magma from~~ mountains to form because magma from the mantle is forced up and out the volcanic mountain to create an eruption which forms land. [3]

- (iii) Briefly explain why volcanoes on this type of plate boundary are usually steep-sided. 3 3

The ~~over~~ collision of two oceanic and continental plates cause one to be forced under the other and the Sunda plate begins to heap up and create steep mountains. [2]

- (iv) Suggest why volcanically active regions, such as Java, often support high population densities.

The land is very lush and the climate is very beautiful in this area. The soil is fertile and from volcano eruption decay, and therefore good for growing rich crops so many people make their livelihoods here. [2]

Example candidate response – high, continued

- (b) Fig. 1.2 shows the volcanic hazards associated with an eruption of Mount Merapi, one of Java's most active volcanoes.

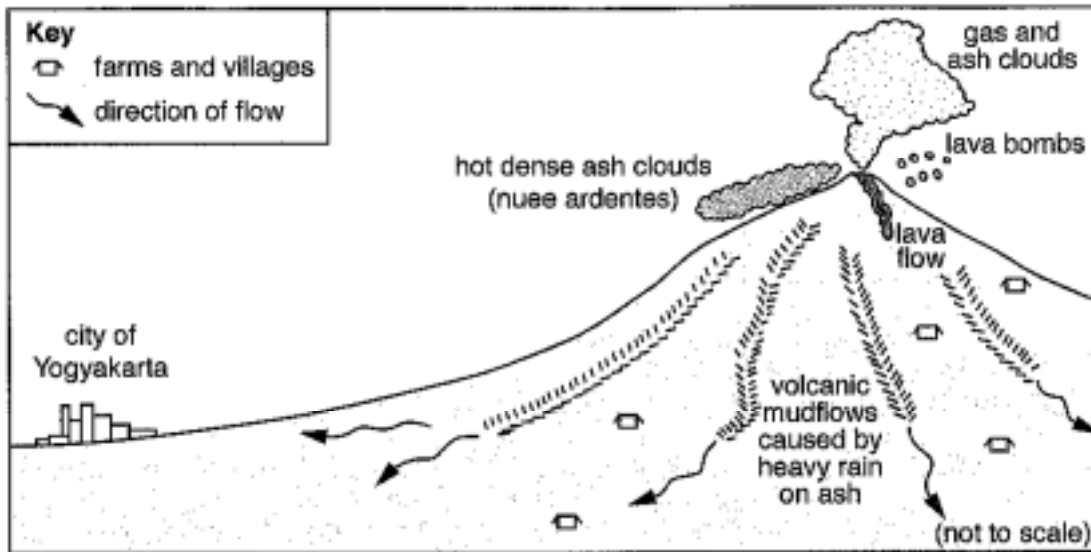


Fig. 1.2

Describe how the volcanic hazards which threaten farmers on the slopes of Mount Merapi might be different to those threatening the inhabitants of Yogyakarta.

The farmers on the slopes would face the hazards of falling lava bombs, and mudflows because of how they are right at an eruption. Lava flows may destroy their homes as well as the mudflows. However, for the inhabitants of Yogyakarta, they would face the hazards of the hot dense ash clouds drifting to the city, and the gas and ash clouds. These clouds would impede breathing and cause burns.

44 [4]

Example candidate response – high, continued

(c) Table 1.1 compares the gross domestic product (GDP) of Indonesia with other countries in the Asia-Pacific region that are at risk from natural hazards.

country	GDP per person/ US\$
Japan	46 000
New Zealand	31 000
Indonesia	4 800
Philippines	4 400
Papua New Guinea	1 850

Table 1.1

With reference to Table 1.1, suggest how the level of economic development of a country might affect both short and long term responses to natural hazards derived from plate movements.

short term ... if the country is more economically developed (MEDC) like Japan with a GDP of \$46000 (Table 1.1) they would probably have emergency services & facilities and services like hospitals/ambulances/firetrucks. However, if the country is less economically developed (LEDC) like Papua New Guinea with a GDP of \$1850 (Table 1.1) there may not be any emergency services, and shelters that are stable enough to house those whose homes have collapsed. LEDCs mainly rely on foreign support from MEDCs.

long term ... MEDCs like Japan and New Zealand would be able to have the financial ability to help their people rebuild their homes and infrastructure with government grants, whereas LEDC governments like the Philippines (Table 1.1) cannot afford to help their people rebuild, and often the people are left homeless.

~~In the Department~~ Earthquakes may actually stimulate economic growth in an MEDC like New Zealand (Christchurch) and increase the construction industry and therefore GDP.

[8]

[Total: 20]

17 17

Examiner comment – high

This candidate providing good detailed answers with supporting and developed points.

1(a) (i) Correct answer.

(ii) Three valid points made

(iii) This question proved difficult across the exam. This candidate is describing the slope of the subduction zone as shown by the diagram (Fig.1.1), rather than the reason for the steep sides of the volcano. Candidates need to realise that the shape is a result of the nature of the lava flow.

(iv) A valid reason provided with developed explanation.

1(b) Four valid points made.

1(c) The candidate provided several valid points with appropriate development and supporting points. The candidate needed to suggest another factor such, as the effect of poor education, in order to access full marks.

Total mark awarded = 17 out of 20

Example candidate response – middle

- 1 (a) Look at Fig. 1.1 which shows the location of Java in south east Asia and an enlarged cross section of the plate boundary, labelled as line A to B.

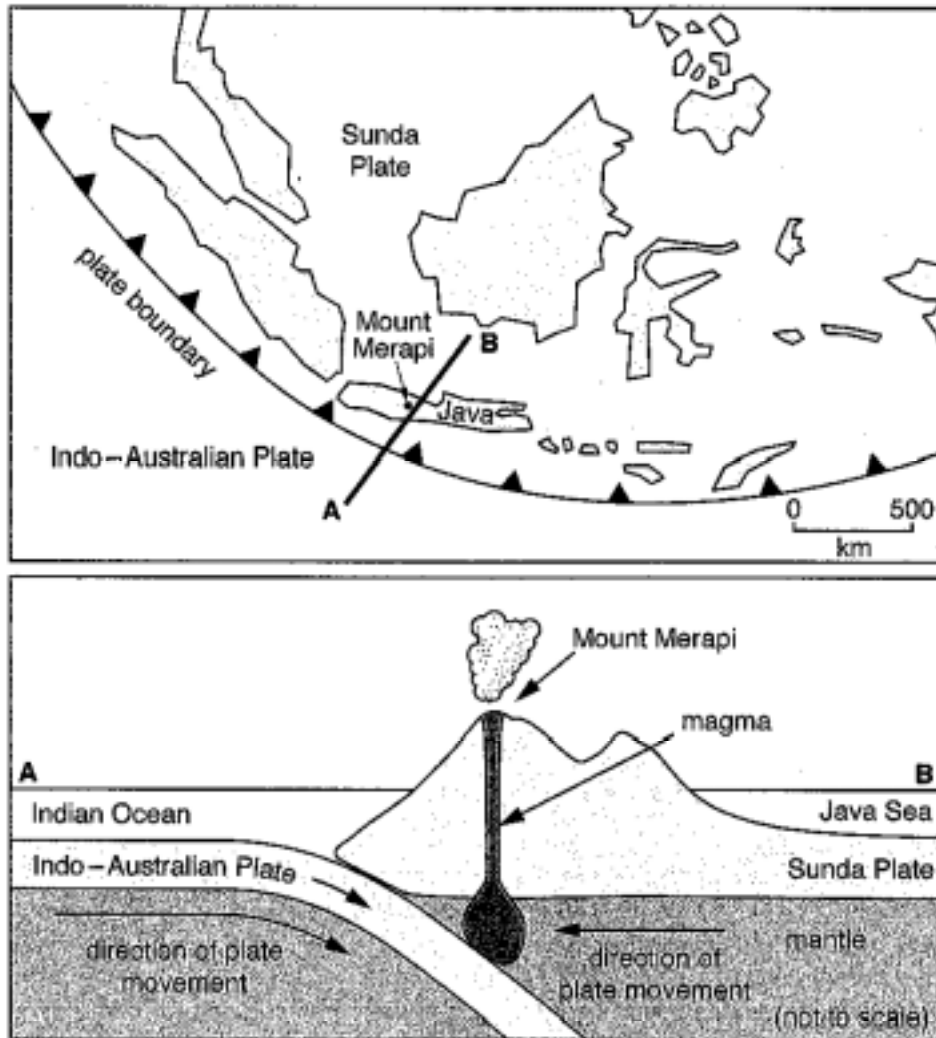


Fig. 1.1

- (i) State the type of plate boundary shown in Fig. 1.1.

Convergent boundary

[1]

Example candidate response – middle, continued

- (ii) Explain the processes that cause volcanic eruptions along the plate boundary shown in Fig. 1.1.

Subduction is what happens when ~~oceanic~~ lithosphere ~~oceanic~~ plates slide into and under ^{other land} oceanic plates. The plates converge, colliding and disrupting pools of magma under/inside the volcano, which then erupts. (6)

- (iii) Briefly explain why volcanoes on this type of plate boundary are usually steep-sided.

The volcanoes on convergent plate boundaries are steep-sided because one plate crashes into and slides above another creating a steep angle on the opposite sides of the boundary. (2)

- (iv) Suggest why volcanically active regions, such as Java, often support high population densities.

Volcanically active regions provide surrounding lands with nutrient rich soil that is useful for agriculture and farming which many of these areas economies are based on. This is attractive to farmers and natives. (2)

Example candidate response – middle, continued

(b) Fig. 1.2 shows the volcanic hazards associated with an eruption of Mount Merapi, one of Java's most active volcanoes.

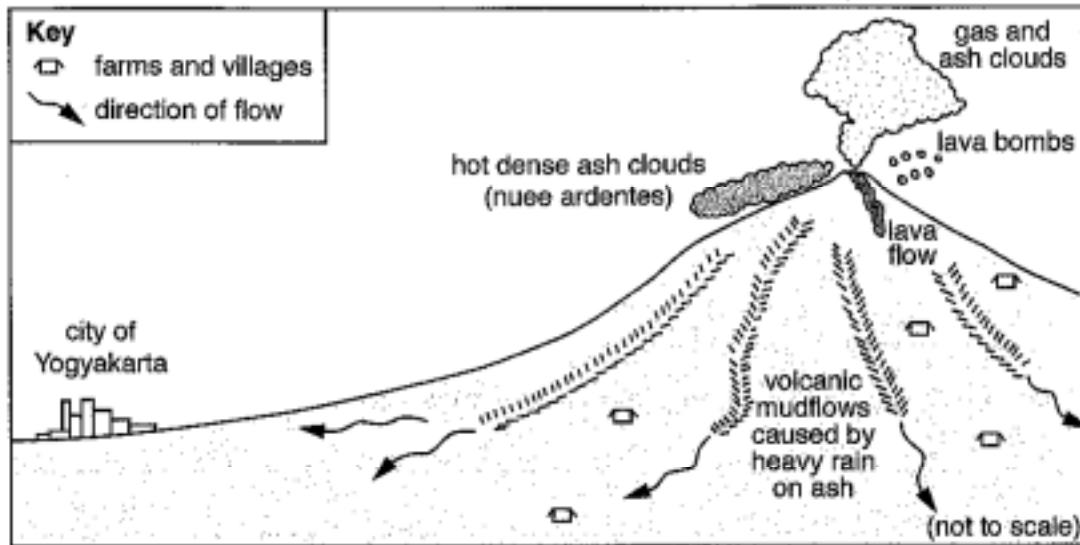


Fig. 1.2

Describe how the volcanic hazards which threaten farmers on the slopes of Mount Merapi might be different to those threatening the inhabitants of Yogyakarta.

The farmers on the slopes of Mount Merapi are threatened by lava flow and lava bombs and volcanic mudflows caused by heavy rain on ash more than the city of Yogyakarta because of their close vicinity to the volcano. However, the city of Yogyakarta is threatened more by gas, ash clouds, and hot/dense ash clouds that may drift with the wind over the city. They may also be threatened equally as threatened by volcanic mudflow because there is one arrow pointing towards the city and one pointing toward a farm as well.

Example candidate response – middle, continued

- (c) Table 1.1 compares the gross domestic product (GDP) of Indonesia with other countries in the Asia-Pacific region that are at risk from natural hazards.

country	GDP per person/ US\$
Japan	46000
New Zealand	31000
Indonesia	4800
Philippines	4400
Papua New Guinea	1850

Japan's economic development has allowed them to build buildings that are earthquake resistant because they can afford the research and new technology.

Table 1.1

With reference to Table 1.1, suggest how the level of economic development of a country might affect both short and long term responses to natural hazards derived from plate movements.

short term ... More economically developed regions have more resources and money to utilize in natural disaster situations than lesser developed nations. Earthquakes, eruptions, and tsunamis caused by plate movements can thus be reacted to more swiftly when forces are called in to search and rescue victims, treat them, and provide them with healthcare.

long term ... In the long term, any development that has been destroyed from earthquakes, tsunamis, and eruptions from plate movements can be more easily cleaned up (debris, etc.) in more economically developed regions. More buildings can be rebuilt in a shorter amount of time as well. Also those with chronic health problems would have better access to treatments because of their or their government's amount of wealth. Papua New Guinea would have a much harder time recovering than New Zealand or Japan because of their low GDP in comparison.

[Total: 20]

Examiner comment – middle

1(a) (i) Correct answer.

(ii) The candidate scores the subduction mark but doesn't go on correctly to refer to melting and the build-up of pressure in order to obtain the remaining marks.

(iii) Incorrect answer which is describing the subduction zone rather than the steep-sided volcano.

(iv) A valid reason provided with developed explanation.

1(b) Three valid points made. The last point about mudflows is not well described.

1(c) This is an example where a candidate has wasted time and space by repeating unnecessary phrases (earthquakes, tsunamis and eruptions from/caused by plate movements). Five marks scored but no space left to access the remaining points. Candidates need to avoid repetition and labouring a single point and to aim for more concise but accurate responses.

Total mark awarded = 12 out of 20

Example candidate response – low

- 1 (a) Look at Fig. 1.1 which shows the location of Java in south east Asia and an enlarged cross section of the plate boundary, labelled as line A to B.

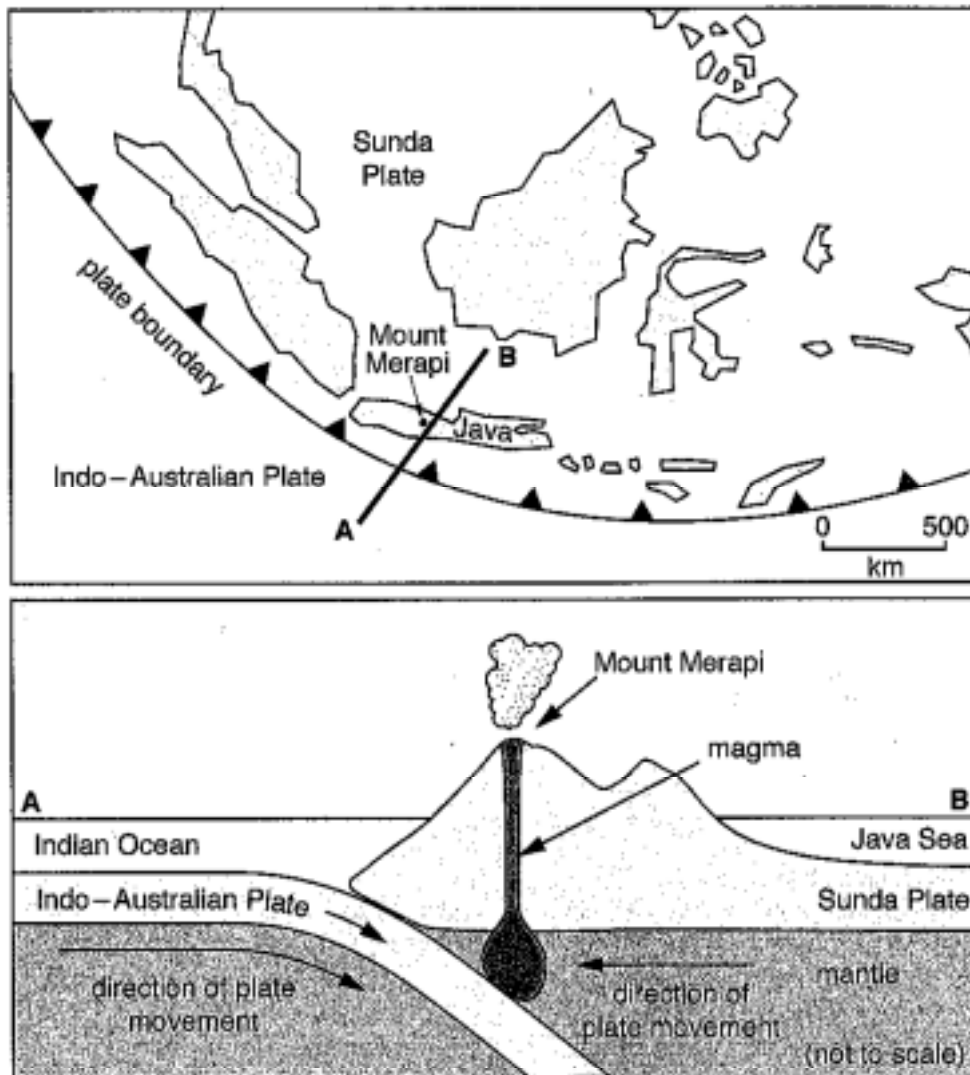


Fig. 1.1

- (i) State the type of plate boundary shown in Fig. 1.1.

Convergent plate boundary

[1]

Example candidate response – low, continued

- (ii) Explain the processes that cause volcanic eruptions along the plate boundary shown in Fig. 1.1.

Volcanic eruptions can occur because of built up pressure below the volcano due to the submerging Indo-Australian Plate.

[3]

- (iii) Briefly explain why volcanoes on this type of plate boundary are usually steep-sided.

Volcanoes on this type of plate boundary are steep sided because of the Indo-Australian plate pushing the volcano down, as well as the tectonic forces created because of the submerging plate.

- (iv) Suggest why volcanically active regions, such as Java, often support high population densities.

Volcanic islands such as Java support high population densities because of the mineral rich volcanic soil created from eroded rock, which can support agriculture.

Example candidate response – low, continued

- (b) Fig. 1.2 shows the volcanic hazards associated with an eruption of Mount Merapi, one of Java's most active volcanoes.

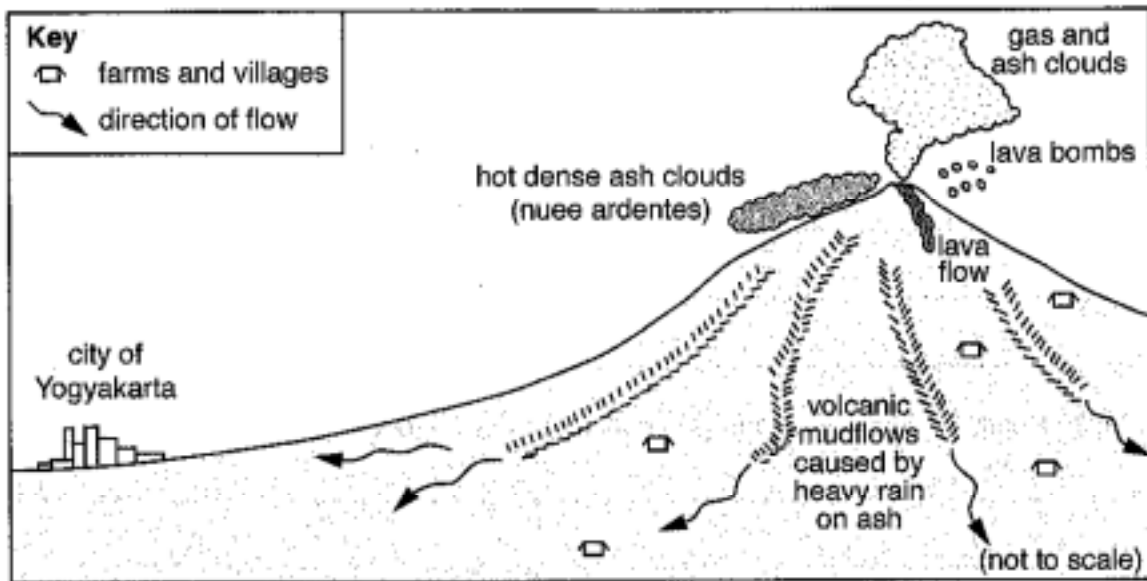


Fig. 1.2

Describe how the volcanic hazards which threaten farmers on the slopes of Mount Merapi might be different to those threatening the inhabitants of Yogyakarta.

Farmers on the volcano may be more threatened by lava flows earlier than those in the city because of how close they are to the volcano, and the lava bombs are in close vicinity to those on the mountain than those in the city. Because of these effects, the farmers have less reaction time to an eruption than those in the city.

[4]

Example candidate response – low, continued

(c) Table 1.1 compares the gross domestic product (GDP) of Indonesia with other countries in the Asia-Pacific region that are at risk from natural hazards.

country	GDP per person/ US\$
Japan	46 000
New Zealand	31 000
Indonesia	4800
Philippines	4400
Papua New Guinea	1850

Table 1.1

With reference to Table 1.1, suggest how the level of economic development of a country might affect both short and long term responses to natural hazards derived from plate movements.

short term In the short term, those who have a higher GDP, such as Japan, will be able to recover from a natural disaster than those compared to a LEDC, such as Papua New Guinea. As well, because of the greater technological development and wealth, those in HEDCs, which allow for greater infrastructure to be built in a shorter amount of time compared to those in LEDC.

long term In the long term, those in HEDCs can have earlier warnings to natural disasters, because of their greater technological advancements, and relief from other countries can help in HEDCs more because of their superior infrastructure compared to those in LEDCs.

10 ✓

[8]

[Total: 20]

Examiner comment – low

This is an example of a candidate with some knowledge but who has not provided sufficient detail for some of the longer answers in order to access all the available marks.

1(a) (i) Correct answer.

(ii) Two valid points made. The candidate needed to refer to melting for example to gain the final mark.

(iii) This candidate is describing the slope of the subduction zone as shown by the diagram (Fig.1.1), rather than the reason for the steep sides of the volcano.

(iv) A valid reason provided with developed explanation.

1(b) In this question the candidate has described a time and related response point linked to the distance of the farms from the eruption. To access the remaining marks the candidate needed to refer to the potential damage and risk to life faced by the farmers (or comparative reference to the city). The candidate wastes exam time and writing space by repeating the same point in the opening paragraph.

1(c) In this answer the candidate demonstrates a confused understanding of the differences between LEDC and MEDC countries. There are three valid points made but the candidate needed to have developed these points in greater detail or provided some of the other possible reasons (see mark scheme).

Total mark awarded = 10 out of 20

Question 2

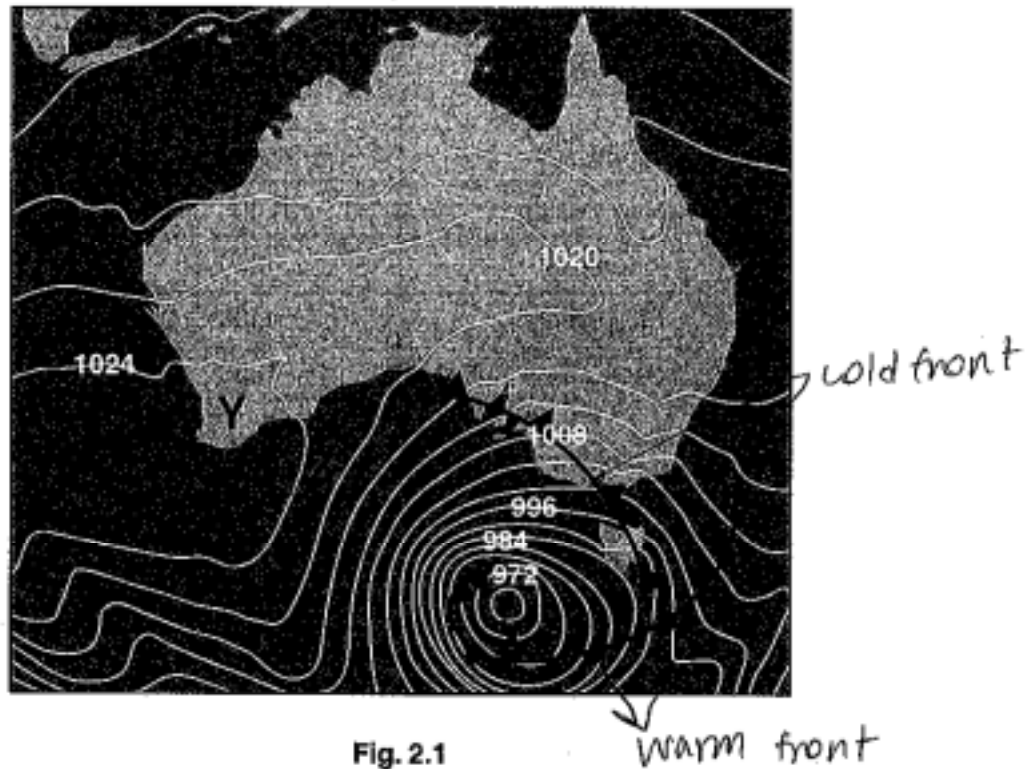
Mark scheme

- 2 (a) (i) X** Low / depression / cyclone / temperate frontal depression / low pressure system;
- Y** High / anticyclone / high pressure system; [2]
- (ii)** Strong winds; variable wind direction and speed; storms; high cloud cover levels; high rainfall totals; low temperature range; mild in winter; cool in summer. [5]
- (iii)** Winds travel approximately parallel to the isobars; coriolis force; air circulates clockwise; around low (or anticlockwise / counter clockwise around high / **Z**); wind direction is from south west; high pressure to low pressure movement of wind. [2]
- (iv)** hazard: drought / bush-fire / poor air quality / high pollen count / high temperatures;
- description: anticyclone conditions; sinking air; clear skies; dry surface conditions; absence of any precipitation for long periods; [3]
- (b)** Direction of travel; speed of travel; timing of landfall; location of landfall; size of area affected; some indication of intensity of precipitation and / or winds; nature of area of expected landfall; evacuation; defence of property; provision of emergency aid; advancing scientific understanding.
- Credit valid alternatives.* [8]

[Total: 20]

Example candidate response – high

2 (a) Fig. 2.1 shows a weather chart for Australia.



(i) Give the name of the type of pressure system found at:

- X ~~Warm front~~ low pressure / depression / cyclone
 Y High pressure / anticyclone

2 [2]

(ii) Describe the general characteristics of weather typically associated with the pressure system at X in Fig. 2.1.

In a low pressure system, air spirals into a low pressure vortex. The air rises so produce cloud and rain. In low pressure systems the air rises, cools, condenses and forms clouds of condensation and precipitation. At the warm front, right in front of the X, the warm moist and dense air is rising gently over the cold air, and this produces condensation and precipitation. clouds are overcast and there is usually steady drizzle. At low pressure areas there will be extensive ^{cloud cover and} rain, + heavy rains.

[5]

Example candidate response – high, continued

(iii) Explain why the surface wind direction at Z in Fig. 2.1 is south westerly.
In the southern Hemisphere, due to the ^{earth's rotation and} Coriolis force, air is deflected to the left of the pressure gradient. ^{The air here is south westerly} High pressure systems ~~move~~ because air is moving ~~into~~ the low pressure system. Air moves from high to low pressure, from anticyclones to cyclones. In the southern Hemisphere (Antarctica), low pressure systems move [2]

(iv) State one natural hazard associated with the weather system at Y. Briefly describe the atmospheric processes that contribute to this hazard.
hazard At Y one natural hazard would be drought for a long time.
description High pressure systems receive descending air which ~~is~~ ^{is} compressed adiabatically. There is reduced humidity and usually high pressure systems are warm and dry. Skies are also usually clear. ^{and there be} High pressure systems ~~so that would lead to strong dry winds~~ (Föhn) or droughts which would reduce crop production. The winds would create a tornado, but due to the lack of rain (clear skies), and as there is no condensation and precipitation, a drought may be produced. Temperatures will be warm to high and wind speeds low to still. [3]

clockwise, and high pressure systems move anti-clockwise.

Example candidate response – high, continued

- (b) Fig. 2.2 shows a satellite image of a hurricane called Tropical Cyclone Yasi, approaching the coast of Queensland, Australia in February 2011.

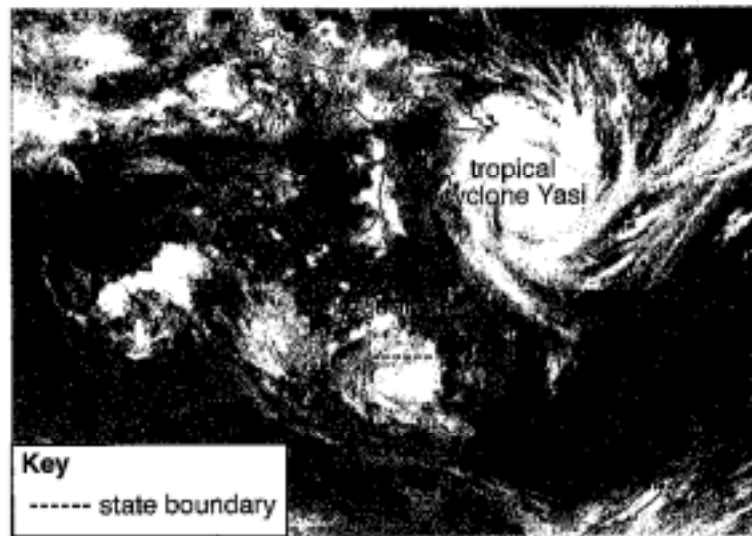


Fig. 2.2

Discuss how satellite monitoring of Tropical Cyclone Yasi might have provided useful information on this approaching hazard and enabled the people of the region to prepare.

Satellites are used to monitor and interpret weather. They can monitor frontal systems and will use the pattern of cloud development to indicate rising air and condensation, the junction of cold and warm air, the likely passage of weather, wind directions, the intensity of the system and the type of weather system. Satellites whether infrared or visible will show clouds as black and dark or white. If at day they can show clouds anyway, or if at night, cold conditions can be laid over outlines of land masses. Therefore satellite monitoring of tropical cyclone Yasi ^{would} have been important as it would have shown how far offshore the cyclone was from land, and it would have also predicted the strength, speed, and route of the storm. This would have allowed for people to evacuate if necessary and to prepare rescue and relief measures for when ~~it~~ ^{it} did reach the shores of Queensland. However even with satellite monitoring cyclones bring in frontal rains, and sea waves cause flooding. There is structural damage to buildings and no one has found a mechanism for stopping them, with global warming they are getting worse.

[9] 15
[Total: 20]

Examiner comment – high

This is an example of a quite good paper from a candidate who provided a lot of information for all the questions and potentially should have accessed more marks. Sometimes this candidate provides too much information such as lists of alternative answers which wastes time in the exam which would be better spent on other answers.

2(a) (i) Five correct points made where only two are required.

(ii) Here the candidate doesn't provide the appropriate adjective to rainfall so loses the mark. The bulk of the rest of this answer is describing how the effects are created, which is not what the question required and so marks were not gained. The rainfall mark is gained in the final sentence but other marking points such as storms, strong winds and temperature range are missed.

(iii) A strong answer, which scores both marks

(iv) A correctly identified hazard in drought but the addition of tornado is incorrect. However, the correct description of the atmospheric conditions allows the candidate to score all three marks.

2(b) This is a longer-answer question which gives the candidates the opportunity to say everything they know and understand about a topic. There must be eight distinct points made or less if they are supported and developed further. This candidate has scored six marks through having made six distinct points. The remaining marks could be from further points (see mark scheme) or by developing one or two of the points made in more detail.

Total mark awarded = 15 out of 20

Example candidate response – middle

2 (a) Fig. 2.1 shows a weather chart for Australia.

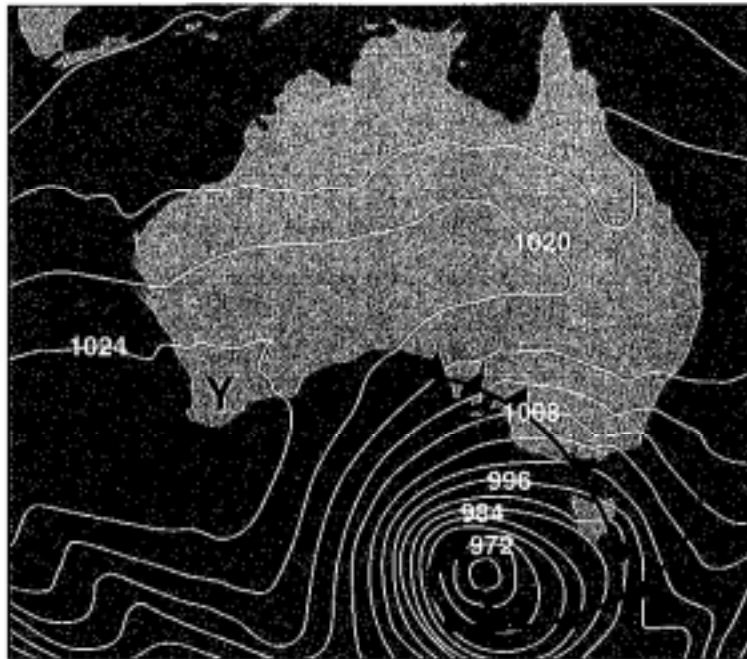


Fig. 2.1

(i) Give the name of the type of pressure system found at:

X ~~low~~ ^{low} pressure ✓
 Y ~~low~~ ^{low} high pressure ✓

✓
 2 [2]

(ii) Describe the general characteristics of weather typically associated with the pressure system at X in Fig. 2.1.

heavy wind and rain heading in a shifting wind direction. Frequent temperature decrease and then clear skies perhaps.

✓
 3

[5]

Example candidate response – middle, continued

- (iii) Explain why the surface wind direction at Z in Fig. 2.1 is south westerly.

The direction of wind is south westerly because that far from the centre of the storm, the weather band has rotated to ~~spread~~ and dissipate southward. [2]

- (iv) State **one** natural hazard associated with the weather system at Y. Briefly describe the atmospheric processes that contribute to this hazard.

hazard ... Sea surge/swell

description ... due to changes in pressure and with the ocean can reach a much higher tide than usual causing erosion and property damage and flooding. [3]

Example candidate response – middle, continued

- (b) Fig. 2.2 shows a satellite image of a hurricane called Tropical Cyclone Yasi, approaching the coast of Queensland, Australia in February 2011.

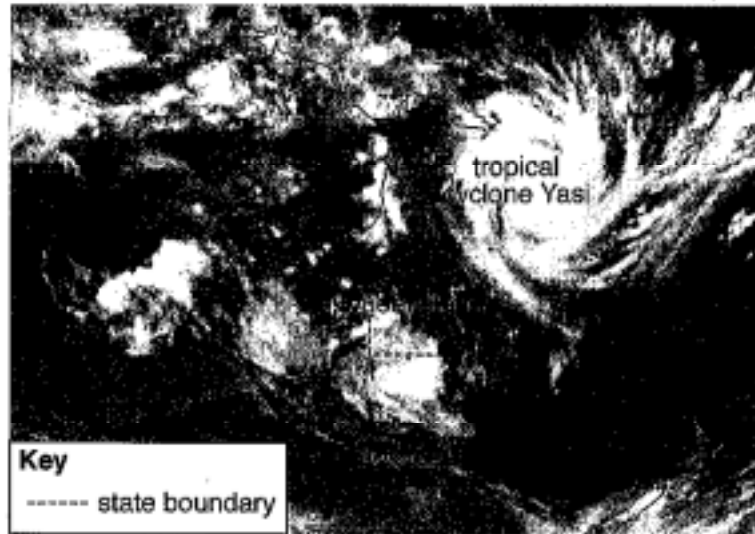


Fig. 2.2

Discuss how satellite monitoring of Tropical Cyclone Yasi might have provided useful information on this approaching hazard and enabled the people of the region to prepare.

satellite monitoring allowed for scientists to make predictions of where the system will travel to next. They can predict on size what areas will be affected and how strongly. Often allowing time to install shutters or evacuate if necessary.

94 ✓
[8]
[Total: 20]

Examiner comment – middle

- 2(a) (i)** Two correct points made, though clearly the candidate had second thoughts.
- (ii)** Heavy describes both the wind and rain for two marks. The candidate missed points such as cloud cover and temperature range for full marks.
- (iii)** Incorrect answer showing that the candidate does not understand the process.
- (iv)** Incorrect choice of hazard and shows no understanding of the atmospheric processes involved.
- 2(b)** This longer answer suffers from not providing sufficient or developed developed points to access all the marks available. The candidates should be aware that the space provided is an indication as to the length of answer normally required to access all the marks available. This is a short and concise answer.

Total mark awarded = 9 out of 20

Example candidate response – low

2 (a) Fig. 2.1 shows a weather chart for Australia.

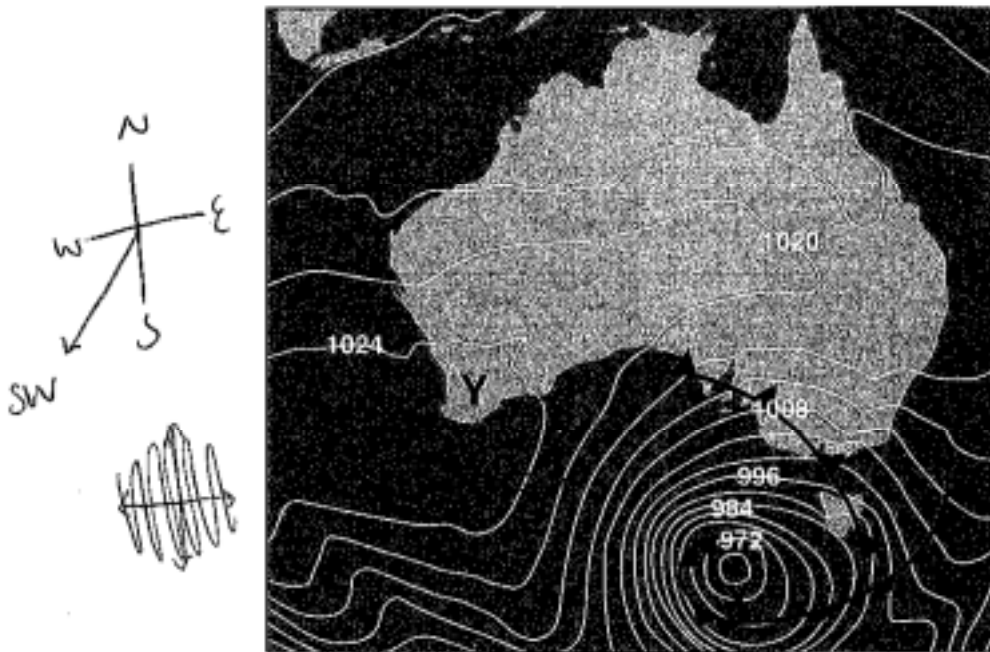


Fig. 2.1

(i) Give the name of the type of pressure system found at:

x high pressure

y low pressure

(ii) Describe the general characteristics of weather typically associated with the pressure system at X in Fig. 2.1.

- The pressure system at X has generally warm temperatures

- ~~There~~ High levels of precipitation are associated with pressure system X

- The temperature and levels of precipitation are generally constant at this pressure system

- Pressure system X may experience hurricanes although they are rare.

[5]

Example candidate response – low, continued

(iii) Explain why the surface wind direction at Z in Fig. 2.1 is south westerly.

- the surface wind direction at Z is south westerly because of the Hadley cells
- this area is below the Hadley cells, which blow north east, thus the wind at Z is south east. [2]

(iv) State **one** natural hazard associated with the weather system at Y. Briefly describe the atmospheric processes that contribute to this hazard.

hazard ... HURRICANES

description - the low pressure at weather system Y allows for the slow formation of a hurricane because the warm waters are have a strong current which the low pressure the low pressure warms the water further allowing a hurricane to form [3]

Example candidate response – low, continued

- (b) Fig. 2.2 shows a satellite image of a hurricane called Tropical Cyclone Yasi, approaching the coast of Queensland, Australia in February 2011.

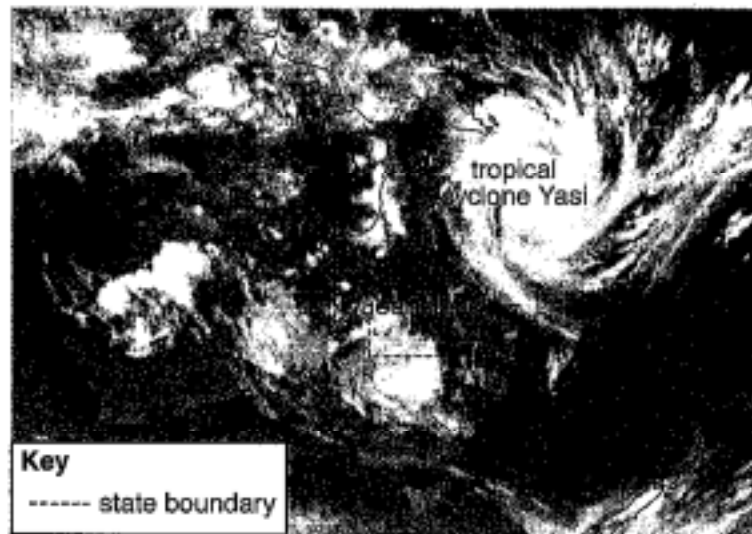


Fig. 2.2

Discuss how satellite monitoring of Tropical Cyclone Yasi might have provided useful information on this approaching hazard **and** enabled the people of the region to prepare.

- Satellite monitoring of Tropical cyclone Yasi would have shown how fast the tropical cyclone was approaching land
- Satellite monitoring would have also allowed the people to see if the tropical cyclone had gotten larger or smaller, which would have allowed citizens to better prepare
- Satellite monitoring allows the people of the region to see which areas are going to get hit first and which areas are going to get hit the hardest
- Satellite monitoring informs the people which areas are the safest
- Satellite monitoring also allows the people to know when ~~approxiamt~~ approximately the tropical cyclone will have ~~passed~~ passed.

[8]
[Total: 20]

Examiner comment – low

- 2(a) (i)** Here the candidate clearly recognises the subject area but is confused over which area of pressure is which.
- (ii)** Here the first and third points given are incorrect. The second and last points are correct but are insufficiently detailed to gain any extra points or development. The candidate needed to provide three further points or to develop the existing points in more detail.
- (iii)** This is an example where the candidate has an idea of the factors which may be involved so includes them in an answer which unfortunately is incorrect. Sometimes this strategy can be successful if the candidate is unsure about the exact answer especially if the mark scheme includes a reference to a point or factor such as the Coriolis Effect, or in this case the Hadley Cells.
- (iv)** The confusion from part **(i)** has carried through here with the wrong choice of hazard and the explanation does not relate to atmospheric conditions.
- 2(b)** There are three points correctly made. The last two points are examples of the same point being repeated in a different way or the reverse argument of a point made, which is in effect a repetition as well. Candidates must beware the pitfalls of repetition – they may feel that they have provided a long and detailed answer but in effect they have lost marks because they have repeated or restated earlier points.

Total mark awarded = 6 out of 20

Section B

This consists of an essay question selected from a choice of three. Each has two parts with a shorter ten mark part and a longer thirty mark part. It is equal to half the marks of the paper.

Question 3

Mark scheme

- 3 (a) Natural environment: loss of permafrost; damage to fragile vegetation; air (land and water) pollution (local climate change); loss of habitats.

Peoples: disruption to migration of reindeer; loss of traditional ways of life; loss of livelihood/incomes; health issues.

Please use level descriptors 1

[10]

- (b) *The question requirements are:*
- *to identify how resources can be protected*
 - *to evaluate the effectiveness/success of protected areas*
 - *to include relevant examples*

Indicative content:

Planning controls over extractive industries; monitoring levels of pollution; use of taxation / legislation;
land-use zoning / landscaping; creation of protected areas / routes; limiting access; consideration of native lifestyles / economies;
environment assessments to protect biodiversity.

Please use level descriptors 2

[30]

Example candidate response – high

Question	Part	
3	a	<p>There are numerous possible threats to the natural environment and the people in the Yamal Peninsula in subarctic region of Arctic Russia if companies decide to extract natural gas from the region. Firstly, a pipeline and railway would have to be constructed right next to the people's summer/winter pastures. This would destroy the wildlife and scar the beauty of this scene. There would further be noise pollution and air pollution from the trains. This would destroy the people's livelihoods as they would no longer be able to freely migrate with their reindeer. There would be a lack of food for both human and herd as they are gathered and the vegetation would be destroyed causing wildlife to die.</p> <p>Additionally, oil platforms and rigs would have to be built. This would increase even more the noise pollution, visual pollution, and air pollution from the "red flare" or when they burn off the natural gas. Visual pollution would involve spoiling the scenery by building pipelines and rigs. Noise pollution would result from the loud noise of drilling. The rigs would be eyesores! Plus all this additional machinery brought to the area would heat up the ice causing it to melt and flood certain areas.</p> <p>But perhaps the most dangerous threat would be the chance of an oil spill, either from a rig itself or a burst pipeline. This would permanently add to pollution, killing all species and plants that come in touch with it. The people, as nomadic hunters, would have no where else to travel to, resulting in lack of food and resources, maybe even death.</p> <p>Overall, bringing oil and gas extraction to the Yamal Peninsula would introduce numerous threats to both the people and the natural environment.</p> <p style="text-align: right;">9</p>

Example candidate response – high, continued

Question	Part	
3	b	<p>Rough work. Planning:</p> <p>Intro - Not effective, but some areas trying to conserve</p> <p>#1 - Mention Santa Barbara - Oil Spill</p> <p>#2 - Lake Chabot - Green Algae ← Drought?</p> <p>#3 - Beaches - NO BOD</p> <p>#4 - Using more alternative energy</p> <p>#5 - Conclusion</p> <p>In California, national parks and conservation areas are being made by the government to protect the resources of the lithosphere for future generations. But, not all these have been effective, as seen in the Santa Barbara Oil Spill. The Blue-Green Algae that has formed on Lake Chabot, near San Francisco is another example. Additionally, why is California in the worse drought in history? But some conservation measures have been effective, such as those put on San Francisco beaches and increase in use of alternative energy sources to preserve coal, oil and natural gas.</p> <p>In the past month, May 2015, Santa Barbara on the coast of California experienced the worst oil spill of its life. The beautiful scenic beaches were destroyed by the black sludge of a crashed oil container. Some say this might have been too close to the shore, resulting in a higher likelihood of a crash. But the question is, why haven't authorities thought over ways to prevent such disasters from happening. Maybe oil rigging should be banned from being near scenic areas, but so far the government has not been effective in doing so.</p> <p>eg. At a local lake, Lake Chabot, located in a more urban area, in a suburb of San Francisco, Blue-Green Algae has been allowed to build up. This is killing plants and fish in the lakes. Two dogs who swam in the water even died afterwards. This only happened, as the national</p>

Example candidate response – high, continued

Question	Part	
3	b cont.	<p>parques were not effective in stopping eutrophication. ^{le} le had been allowed to run into the lake from nearby houses and golf courses. This caused algae to build, using all oxygen so plants and fish died from lack of oxygen. Plus, the lake has now now added to visual pollution, as it is unsightly.</p> <p>Furthermore, why is California currently suffering from the worst drought in history? It is common knowledge that the state only received three inches of rain in one of the previous years. But why can't the few water sources the state has be effectively managed? In my local neighborhood there has been no restrictions on watering lawns or gardens. Plans have been suggested, ^{ew} but the government has not been effective in implementing them, resulting in a precious resource needed for the future going to waste.</p> <p>However, California has been effective in conserving national parks. ^{methe} Rules have been enforced such as no barbecues or fires on beaches. Extremely heavy fines are given from if you are found to litter or dump garbage in a national park. When fishing at beaches, it is required to cast baby fish back into the water to protect the species. ^{for}</p> <p>Additionally, California has been effective in implement ^{for} using sustainable to energy sources. Solar panels are excellent for such areas as there is plenty of sunlight. Wind turbines have been placed on hills all over the state. Solar is being used by individuals to reserve coal, oil and natural gas. For example, our swimming pool is run on solar. Cars have been made electric and there has been a serious increase in the environment friendly Teslas.</p> <p>Overall, the state of California has several effective</p>

Example candidate response – high, continued

Question	Part	
3	b. cont	<p>conservation methods. But the state could still do much better and not all conservation projects are effective enough. The journey to preserve has has most certainly begun, it just needs to speed up in order for CA to protect the lithosphere's resources for future generations.</p> <p>Level 2, 2/30 ✓</p> <p>Contains some critique / supportive evaluation</p>

Examiner comment – high

3(a) A very good answer which covers the details of the figure (Fig. 3.1.) and develops the points to add detail. Reference to potential future or continued effects is also a good factor in this answer.

In order to achieve the higher level marks candidates should avoid absolutes in their statements such as wiped out/destroyed/become extinct. Good answers not only describe the effects but develop the points to give details of these effects in both the short and long term. Such answers will also include references to air, water and soil pollution and the associated effects on the environment.

3(b) A good response with named examples and some evaluative comments and suggestions are made for suitable methods employed. The mark is limited however because the candidate does not refer directly to the lithosphere (although the part referring to sustainable energy is an indirect or implied reference to the lithosphere conservation).

The key to success in this essay is the question is about the resources of the lithosphere. Many candidates wrote extensively about the biosphere and although this was given some credit it had to be supported by examples and references to the lithosphere in order to access the higher level marks.

Good answers cited examples and looked at controls over mining and quarrying and how such activities can lead to problems. Points were developed with detailed supporting statements and some evaluative comments made.

Less successful answers ignored, avoided or did not know what the lithosphere was and consequently were self-penalising by not addressing the question.

Total mark awarded = 30 out of 40

Example candidate response – middle

Question	Part	
3	A	<p>Due to the extraction of gas and oil to the region, the Yamal Peninsula can face many extreme environmental dangers. One such danger is habitat fragmentation. Habitat fragmentation is the destruction and breaking down of pieces of environment due to human processes such as settlements and resource exploitation. Due to habitat fragmentation, migratory animals, such as reindeer may have trouble crossing tracks of land, because of human interference. Furthermore, habitat fragmentation can lead to loss of biodiversity. This is due to different populations of animals being separated, decreasing the gene pool, and can lead to inbreeding of organisms. Human impact can also lead to the extinction of species' due to the threats stated above, however habitat loss and fragmentation are the greatest causes of extinction.</p>

Example candidate response – middle, continued

Question	Part	
3	A	<p>Lastly, into industrial processes, such as oil and gas extraction, can lead to the ground and water pollution within the area, because of pollutants and waste being disposed of, in and around the environment, which can damage, kill, or mutate organisms living there.</p>
3	B	<p>All National Parks and conservation areas are very effective at protecting resources for future generations. Many governments can set aside vast areas of land for the conservation and protection of resources for the future. As well, governments can set up agencies, such as the EPA, which allows for the protection and sanitation of environments to continue. One such example of a conservation site, with great protection of resources for the future is the Antarctic National Wildlife Refuge, or ANWR for short. ANWR is an area in the antarctic, where only good where only researchers can go and visit to greater understand the area and life of the organisms in the Antarctic. The main goal of ANWR is to protect and research the land and organisms, and because of its protection, the land cannot be be hunted or destroyed, as well as exploited for resources. Because of this, the land its protection of the organisms, ANWR is an effective example that</p>

Example candidate response – middle, continued

Question Part

eg	<p>The conservation of land can protect the resources for future generations. Another example for the protection and conservation of land for future use is Yellowstone national park. This park allowed for the reintroduction and protection of the Gray Wolf, which allowed the species to come back from the brink of extinction, and Harris. Yellowstone National Park also allowed for the protection of an environment that would otherwise be very fragile, which is also effective for the conservation and protection of resources for future generations.</p> <p style="text-align: right;">15</p> <p style="text-align: center;">Level 3 Some requirements of question fulfilled.</p> <p style="text-align: right;">(23) ✓</p>
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Examiner comment – middle

- 3(a)** This is an example of a good part **(a)**, which scores a relatively high mark but is not supported by as good a part **(b)**. In part **(a)**, the candidate has produced a good description of habitat fragmentation and the consequences including a long-term genetic effect. There is a tendency to use absolutes such as extinction. An opportunity to refer to the impact on the human population was missed and limited access to the full marks available.
- 3(b)** The candidate provides named examples but the response is limited due to lack of reference to the lithosphere. The protected resources named are from the biosphere and whilst not penalising this directly, the response is naturally self-limiting as a result. Similarly the discussion about the Antarctic is limited by the reference to resources but no actual resources are named or described.

Total mark awarded = 23 out of 40

Example candidate response – low

Question	Part	
3	a	<p>As shown in Figure 3.1, there are six oil and gasfields in the Yamal Peninsula. All six of these extraction sites are taking up land that was previously the home for animals' species or ^yes community. Because of the addition of these sites, habitats of animals, like reindeer, and plants are disrupted. If just one aspect of the food web/chain on the Yamal Peninsula is changed, many other animals are impacted as well, including that animals prey and predators. The ecosystem may grow unstable. Similarly, the</p>

Example candidate response – low, continued

Question	Part	
3	a	<p>migration patterns of people and reindeer may be interrupted. With at least one oil and gas field on the migration route, the people and animals will have to develop a new route around the reserve. This may cause them to get disoriented and lost. Furthermore, such extraction sites use chemicals to extract the oil and gas from below the surface. These chemicals could seep into the soil and water, then be could be taken up by plants, animals, and humans. This is detrimental to all living organisms in the area, as it could cause birth defects and cancer. The two oil and gas fields that are directly over a pipeline could accidentally rupture the pipeline. This would release unwanted waste back into the environment. It would also cost cost the people of the area money to repair the pipeline, as well as all the possible problems in the environment. So, pipeline infrastructure, habitats, and health, and the economy could all negatively be disrupted.</p>

Example candidate response – low, continued

Question	Part	
3	b	<p>Also, these areas are kept pristine through rules on trash, and through the work of employees and rangers. As trash could also carry carry foreign species and and become invasive, a natural species could accidentally eat the trash, thus harming its health. So many sites at the Everglades have signs that say not to feed the wildlife, like to the alligators in The Everglades. Hard-working employees are also in place to enforce these rules as well as clean up after any rule-breakers. Habitats, environments, and beauty are all protected through law and legislation in favor of the lithosphere.</p>
		<p style="text-align: right;">15.</p> <p style="text-align: center;">Level 3.</p> <p>fulful some requirements of the question</p> <p style="text-align: right;">(20) ✓</p>

Examiner comment – low

- 3(a)** This is a weaker answer though it still achieves 50% of the marks. To attain higher marks in part **(a)**, the candidate would need to provide greater detail and a wider range of points and avoid the use of absolutes. The points made are valid but the higher marks would be gained by developing these points to describe the potential effects in the future and also the processes involved.
- 3(b)** In this response the candidate references the lithosphere but the answer is superficial and suggests that the candidate has not familiarised themselves with the processes of conservation of the lithosphere. As a result the marks are lower and the candidate resorts to the biosphere for the second part of the answer.

Total mark awarded = 20 out of 40

Question 4

Mark scheme

- 4 (a) Combustion of fossil fuels from industry / power stations / transport releases sulphur dioxide and nitrogen oxide into atmosphere

complex reactions within atmosphere (including oxidation) lead to sulphuric and nitric acids

fall to earth as wet deposition (rain / snow) or dry deposition (particles / gases)

the pollution carried by the winds / run-off

rivers / lakes / forests / soils unable to neutralise acidity leading to biological damage.

Please use level descriptors 1

[10]

- (b) *The question requirements are:*

- *to explain measures for reducing pollution*
- *to explain the difficulties of achieving agreements*
- *to illustrate answer with appropriate examples*

Indicative content:

A variety of pollution control measures and a consideration of their effectiveness;

political disagreement; differing economic interests/priorities; difference in levels of economic development; pollution crosses borders;

named international agreement examples and evaluation of their success, e.g. Kyoto / Rio.

Please use level descriptors 2

[30]

Example candidate response – high

Section B, Question 4

4a) Human activities like driving vehicles releases sulphur dioxide, nitrogen oxide, and carbon dioxide. The combination of these particles with ~~elements~~^{elements} in the air like oxygen mix together to create an acidic formation of molecules in the air. These particles are gradually linked on with ~~the~~ water particles in the air and eventually condensed into the clouds - precipitating ~~to create~~ in the form of acid rain and acid snow.

Industry has similar effects - the combustion of fossil fuels releases a tremendous amount of carbon dioxide and sulfur dioxide as well as nitrogen oxide. These are blowing in the form of smoke, and the smoke particles go upwards into the clouds and pollute the clouds and the water vapour inside them. When it comes time for the precipitation of these ~~materials~~, clouds, the acid compounds come down as well.

The burning of coal and oil for heat and gas vehicles releases acidic compounds into the atmosphere. In Fig 4.1, the vehicles' burning fuel goes into the atmosphere, as does the industrial buildings and homes burning oil and coal for energy. The reason the acidic compounds come in the form of rain and snow is because they are about the same density as the air around and travel with it and latch onto the particles that eventually turn to clouds.

b) It is difficult to achieve international agreement

Example candidate response – high, continued

on reducing atmospheric pollution because of the interests of various countries. For example, a more economically developed country like the ^(MEDC) United ~~States~~ ^{Canada} places emphasis on reducing ~~acid rain~~ acidic contribution to the atmosphere with their 'clean Air Act' that enforces 'no idling ~~in~~ for longer than 3 minutes' in vehicles to reduce ~~the~~ ^{the} acidic emissions of vehicles. In the United States, coal-burning factories have to have ~~the~~ ^{the} devices installed in ~~the~~ ^{the} smokestacks to clean the air on its way out so it is not as dirty. However, this costs the government a lot of ~~the~~ ^{the} money to enforce and promote, and may even be detrimental to industries ~~who~~ ^{who} require causing a lot of atmospheric pollution – like steel manufacturing – because they cannot run as cheaply. It is therefore difficult to convince ~~an~~ ^{an} economically struggling country like China to care about atmospheric pollution. China is mainly manufacturing as its industry, and therefore would emit a lot of harmful atmospheric emissions. The ~~government~~ ^{main} aim of China's industry is to produce as cheaply as possible, and the government implementing ~~a~~ ^a policy against this in an effort to reduce atmospheric pollution would be disrespected and rebelled against. In recent conferences to reduce ~~acid~~ ^{acid} atmosphere pollution, China has showed up to be unwilling to implement such policies because of this.

It is also difficult to reach an international agreement to reduce atmospheric pollution ~~because~~ ^{because} the countries across the world are all at different stages. In

Example candidate response – high, continued

MEDCs, cities have been thriving for a long time, and it has become a concern about the amount of atmospheric pollution. The concern mainly started in London, 1952, when the smog and the air pollution got so bad that the people had to wear gas masks and because all of their houses burnt coal. They then changed the way their homes were heated and reduced the atmospheric pollution. However, in a country that has not even become industrialized like Newly Industrialized (NIC) means that it is trying to grow and expand as quickly as possible with all of its industry. It is therefore unlikely they will implement restrictions on industrial productivity, for and often atmospheric pollution measures restrict industry in some way, or require a more expensive method. In a less economically developed country like Nigeria, the pollution of the atmosphere is likely to only come from burning of oil in conflicts and smaller cities here. Reducing atmospheric pollution is out of their considerations - an oil-burning conflict does not really consider for pollution. It is therefore unlikely they will become involved in concern for the environment when there are other more important issues like poverty and unemployment and conflicts that the government is struggling to deal with. International agreement, therefore, cannot really be achieved to reduce atmospheric pollution because of the different stages of countries. MEDCs have money to spend and programmes to implement these policies, whereas NICs do not care for these policies as much because they are focusing on the growth of their country and

Example candidate response – high, continued

industry that has the consequence of increasing pollution. LEDCs have ~~so~~ so many other problems they must face that are more important to the welfare of the country and therefore do not take environmental issues into their concern very often.

It is also difficult ~~to~~ to reach an agreement internationally to reduce atmospheric pollution because of how ~~difficult~~ difficult it is to enforce. In some countries like the United States and Canada, ~~the~~ ~~en~~ ~~enforces~~ the environment has reached the level of Federal affairs, and the government has specific departments allocated to deal with the enforcement of environmental policies like ensuring its law that all vehicles have a catalytic converter to reduce pollution of vehicles – and making it punishable by fine if the laws are disobeyed. However, in China, the traffic is horrendous and there is little to no enforcement on the road. There are no laws that specify what the pollution standards of vehicles are, so there is a lot more pollution here. There are also millions of more people in China and the police would not be able to deal with the task of ensuring no one is violating pollution laws anyways.

International agreement ~~to~~ on reducing atmospheric pollution is difficult to reach because of ~~how international~~ ~~relationships~~ the different interests of countries, the different stages of economic development, and the level of difficulty to enforce these regulations. There are simply too many countries, cultures, needs and interests in this world to ~~reach~~ reach an agreement on reducing atmospheric pollution internationally. 32/30

Examiner comment – high

- 4(a)** Some inaccuracies towards the end weakened this answer but the candidate demonstrates understanding of the processes involved and provides supporting details. A risk for some candidates in this question is to simply describe the diagram Fig. 4.1. and to not provide the details of the processes involved.
- 4(b)** This is a good essay with good analysis in parts and some evaluative comments. The essay does not refer to any named international agreements or protocols and there are some misunderstandings about the Chinese economy and the reasons behind some of the pollution which left it short of the highest marks.

Total mark awarded = 32 out of 40

Example candidate response – middle

4a) In figure 4.1 the large amount of factories are letting off SO_2 and NO which are the main causes of acid rain. These factories are not acting responsibly and they should be limited to the amount of these dangerous emissions they can let off. The car and truck in Figure 4.1 also ~~represent~~ represent harmful emissions like CO_2 that are being let into the air. There are very few trees in Figure 4.1 to use up the CO_2 so it gets taken up into the atmosphere instead. These dangerous gases that are being produced by human activities then bond with water vapor in the atmosphere, which creates the acid rain compounds. These compounds then ~~the~~ condensate into rain droplets and eventually fall as acidic precipitation. The sulfur dioxide and nitrogen oxide that falls then ends up in water supplies on

Example candidate response – middle, continued

the surface of the earth. ~~This effects~~
 These pollutants effect both people's
 water supply and animals water
 supply.

4

4b) First, countries around the world
 can rarely work together. The differences
 between economically developed countries
 and less economically developed countries
 create disagreements. Many less economically
 developed countries are growing rapidly
 in population and often produce cheap
 products because the government doesn't
 put many restrictions on pollution. An
 example is India whose threaded rod
 producers were dumping waste in
 water supplies, which ruined the water
 and created atmospheric pollution when
 the water evaporated. The U.S. couldn't
 get them to stop so they placed an
 import tax on any threaded rod that was
 imported into the U.S. from India.
 Many countries worry more about the
 GDP of their country than their effect
 on the environment. Even though their
 actions effect the whole world they

Example candidate response – middle, continued

still focus more on large amounts of manufacturing so they export more and the GDP of their country rises. Another dispute between countries about atmospheric pollution arises because of the difference between tertiary and secondary economies. More tertiary based economies or service producing economies produce less pollution so restrictions on atmospheric pollution wouldn't affect them nearly as much. On the other hand, secondary or manufacturing based countries would suffer much more from lowering of atmospheric pollution. This is because their countries rely on manufacturing which is a high amount of factories producing a high amount of dangerous gases like sulfur dioxide and nitrogen oxide. Next, many countries disagree on whether the atmospheric pollution should be restricted based on the amount of land a country has or on the amount of people they

Example candidate response – middle, continued

^{the} have. Large countries with small populations like Russia, argue that they should be able to produce the same percentage of atmospheric pollution as the percentage of ~~land mass~~ the earth's land mass they own. If it was done by population small density populated countries would produce large amounts of pollution in a small concentrated area. They are more likely to effect the neighboring countries which ~~causes~~ causes more disputes. However, ~~these can~~ it would be very hard for these countries not to produce a lot of atmospheric pollution with their large population that need jobs.

Some valid points covered
 showing understanding of nature
 of treaties. level 2 / 19

(23)

Examiner comment – middle

- 4(a)** The candidate refers to the diagram and doesn't appear to realise that this is , a stylised representation. As a result the candidate refers to the lack of trees. This is an example of a weak section **(a)** answer being supported by a much better answer to section **(b)**. The description of the processes and the results of acid precipitation are superficial and more depth and detail would be needed to access the higher range of marks.
- 4(b)** Showing some understanding of the reasons why some referenced countries may not be keen to reach agreement on limiting emissions. Some evaluative comments helped raise the mark, though reference to actual treaties and some of the methods used to solve the problem would have improved access to the higher marks.

Total mark awarded = 23 out of 40

Example candidate response – low

Question
number

4a	<p>Both human activities and atmospheric processes are responsible for acid deposition. Human activities release acids/toxins in the into the atmosphere. Such human activities that release acids are the burning burning of fossil fuels, which releases CO₂ and particulates into the atmosphere, and producing factory production which can release CO₂, mercury, lead, and particulates into the atmosphere. The substances that are released into the atmosphere vary in toxicity, but most can cause damage. Once the acid/toxins, such as lead, mercury, and particulates, are in the atmosphere they bind with water vapor molecules and and/or ozone molecules to form harmful substances, usually acids. Then when it rains, or snows, these acids fall back onto the earth and can cause damage to buildings, statues, and wildlife, and people.</p>
4b	<p>It is difficult International agreements on reducing atmospheric pollution are difficult to achieve because all countries have different priorities and different levels of economic development.</p> <p>All countries have different priorities, this means that not everyone is going to focus the same amount of time, energy, and capital into the solving the same problem. Some countries have development as their top priority, while others may have</p>

Example candidate response – low, continued

Question number	
4b	<p>reducing pollution as their top priority. This is a major reason why global scale agreements on reducing atmospheric pollution are difficult to achieve, not everyone has the same main goal. Countries such as the UK are more economically developed than other countries, this status as an MEDC allows the UK to focus less on development and focus more on protecting the environment through reducing atmospheric pollution. Countries such as China are slightly less economically developed than other countries, this status as an LEDC allows China to focus less on protecting the environment and focus more on economic development. Therefore, by understanding that each country has a different priority it is easy to see why international agreements on reducing atmospheric pollution are difficult to achieve.</p> <p>All countries also have the different levels of economic development, as stated previously. These different levels of economic development mean that some countries have more tech and/or better technology and money than others. Countries with high levels of gross domestic product (GDP) are usually not considered to be more economically developed countries (MEDCs), whereas countries with low levels of GDP are usually</p>

Example candidate response – low, continued

Question
number

4b considered to be less economically developed countries (LEDCs). An example of an MEDC would be the USA and an example of an LEDC would be India. The USA has a high GDP ~~which means~~ and is an MEDC which means the USA has better technology to reduce pollution and more money to do so. India has a lower GDP and is an LEDC which means India has less advanced technology to reduce pollution and less money to do so. These are the reasons why international agreements like the Kyoto Protocol fail; some of the countries have more than enough technology and money to reduce pollution, while other countries barely have any technology to reduce pollution and their money is being spent on development. International agreements on reducing pollution fail because not all countries have equal levels of resources to reduce their levels of pollution.

In conclusion, international agreements on reducing atmospheric pollution are difficult to achieve because countries have different priorities and different levels of economic development. Not all countries have the technology and/or the money to effectively reduce the amount of pollution they put into the atmosphere.

Some relevant arguments developed.
level 3

16

18

Examiner comment – low

- 4(a)** This candidate lists some pollutants but demonstrates weak understanding of their resultant effects and also doesn't provide specific sources for them.
- 4(b)** This essay only makes two points but spends a great deal of time making them before repeating them in the conclusion. The two points are priority and economy compared between more and less economically developed countries. The candidate needed to be more concise and to provide a wider scope of information with supporting details. Some evaluative comments would access the higher level marks.

Total mark awarded = 18 out of 40

Question 5

Mark scheme

- 5 (a) Choice of soil type, e.g. temperate / podzols / brown earths / tropical laterites / rain forest or any other valid soil type

a description of that soil's characteristics

with reference to Fig.5.1. an explanation of how those characteristics reflect the various soil forming factors.

Please use level descriptors 1

[10]

- (b) *The question requirements are:*

- *to explain how deforestation negatively impacts soil*
- *to make an assessment of a variety of methods of sustainable soil management*
- *to illustrate answer with appropriate examples*

Indicative content:

The impact of deforestation on soil fertility, soil structure and texture, depth, drainage

on soil erosion rates, e.g. the loss of protective cover leads to rain splash and rapid surface run-off which can cause gullying and sheet erosion;

Impact on the water and nutrient cycles;

the process of leaching and laterisation in the tropics may be explained;

sustainable management methods might include agro-forestry, intercropping, terracing, mulches / manures, rotations;

examples may be drawn from MEDCs and / or LEDCs.

Please use level descriptors 2

[30]

Example candidate response – high

5	a	<p>Time is an important part of soil development because even if climate is the main factor, which determines the rate of development, it can take up to 400 years for a single centimeter of temperate soils to develop.</p> <p>Deep brown earth soils are another form of soil and they are affected by organisms because earthworms ^{borrow in} integrate the soil, aerate it and increase its organic matter. Furthermore, fungi, bacteria, and invertebrates break down organic matter into nutrients and in the process may also determine pH. Also, brown earth soils are a product of base rich parent litter and warm conditions. Climate affects the development of this soil because the hotter and wetter the climate, the faster the weathering proceeds. Therefore leaves will break down rapidly. Climate also affects plant growth - it determines the amount and rate of water and nutrients that leave the soil. Water will control most other processes that occur in the soil. The breakdown of plant litter and animal faeces will ^{into humus} accelerate in hot wet climates so this creates the brown earth soils. Humus will form aggregates to improve the soil physical properties for plant growth, and humus will provide phosphorus, nitrogen and sulphur. Topography is also important in that the altitude and aspect will affect relief. Gradient will also</p>
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Example candidate response – high, continued

Question	Part	
		<p>affect drainage ^{on steep slopes} water moves downhill, which encourages nutrients and particles to move with it. This should leave behind a clay soil with a neutral pH. Parent material is also important - underlying rock and sediment weathers to create mineral matter.</p> <p>If the underlying rock is granite or hard, like igneous rock, the weather and soil formation will occur slowly.</p> <p>The perfect soil, loam, has 40% silt, 40% sand, and 20% clay. Clay will hold nutrients and water and will have large pore spaces, to allow for good drainage and aeration, and silt will hold sand and clay together.</p>
5	b	<p>Deforestation ^{of} means that roots ^{vegetation is} cleared, and this means that ^{roots} which previously held the soil together, are lost. This can lead to an exposure of the soil to the weather. rains can then erode the soil away, or winds can - without roots to hold the soil in place, the soil can be blown away in the wind. rains either seasonal or storms, will encourage rapid erosion and surface drainage of the loose unconsolidated surface. ^{an} example of this soil erosion is in Indonesia.</p> <p>Most Much of Indonesia's lowland vegetation covers tropical rainforest - it has been called the Amazon of Southeast Asia. Rates of deforestation are increasing and tropical rainforest destruction has been accelerating. Some people blame this on the ^{greedy} logging companies, others blame it on the government and its large development projects, and others blame it on the population increase. The increasing ^{high} population densities have led to to slash and burn to increase ^{by}</p>

Example candidate response – high, continued

Question Part

	<p>food supplies. The government's transmigration policy, which aimed to relieve overcrowding in cities such as Jakarta, has led to the clearance of forests - over ^d 7 million hectares has been cleared, to make space for settlements and farmland. The military government also gave concessions to logging companies in 1998, which were run by powerful people, with political influence. There has been little or no attempt to reduce the ^{or} illegal logging or to enforce replanting schemes and selective logging. Economic pressures have led to this soil erosion and deterioration - the country needs money to pay for international debts for development economically. Indonesia is a major exporter of wood and wood products, and the ^{wood} brings in big money in the developed world. Over 700,000 people are employed in the logging mills and unemployment is only made worse by the rapid population increase. The expansion of slash and burn farming has increased the number of plots used in a non-sustainable way and the high population density means there is an increased need for food, work ^{and} ^{and} services. This ^{has} ^{led} ^{to} ^{deforestation} ^{and} ^{pressure} ^{on} ^{natural} ^{resources}.</p> <p>This ^{has} ^{led} ^{to} ^a ^{loss} ^{of} ^{habitats}, ^{biodiversity}, ^{net} ^{primary} ^{productivity}, ^{and} ^{wildlife}. Furthermore, soil erosion, or a natural process, occurring after roots have been removed, is now a major problem. Periodic rainfall can cause sheet washing - surface storage turns into surface runoff. Deforestation ^{exposes} ^{the} ^{soil} ^{to} ^{the} ^{natural} ^{elements} - precipitation reaches the surface, as there is no biomass to intercept ^{the} ^{rainfall}. Soil washes ^{down} ^{slopes}, encouraging ^{gully} ^{erosion} and ^{rill} ^{development}. Nutrients are also lost from the soil. This has also been a problem ^{near}</p>
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Example candidate response – high, continued

Question Part

Bangladesh. Large areas of forest have been cleared or in Nepal, and Tibet, where the rivers Ganges and Brahmaputra have their sources. This increases flood risk in Bangladesh - ^{a country} with one of the highest flood risks in the world, ^{and it} risk from a rise in sea level due to global warming. However, in Indonesia, deforestation has also led to silting of rivers (encourages flooding) and there is serious air pollution from forest fires. Air pollution was the worst in the fall of 1997. Forest fires were deliberately lit by logging companies and farmers, to clear land for growing crops. The excessively dry weather meant that these quickly spread out of control.

Deforestation is also a problem in the Amazon. The main form of forest destruction is the extraction of mahogany for the exports, mainly to the US and UK, of luxury furniture products. The trees are so valuable, that logging companies are prepared to build roads and burn large areas of worthless forests to enable extraction. The nearest legally available areas of mahogany have already been removed, so logging companies have moved into areas set aside for the protection of wildlife and native Indians. The trees are very valuable, but widely dispersed, so the damage done by logging is disproportionate to the amount of trees removed. Also, genetic diversity is harmed, because only the best, the straightest and the tallest trees are taken. Also, in 1994, the ^{Dutch} ^{at a} ^{meeting} suggested mahogany be added to the Convention, which ^{in future} would require logging companies to obtain an export licence from the Brazilian government which would be required to ensure the trade did not harm wild species. The international tropical timber industry was heavily

Example candidate response – high, continued

Question Part

opposed to them, claiming the underwriters estimate of the number of mahogany trees left in Brazil was unreliable. Logging companies claimed they are acting in an environmentally responsible way, by establishing mahogany plantations to replace the trees extracted. However the plantations are insignificant given the scale of extraction.

Soil quality can be sustainably managed for agriculture in a variety of ways. One way is if the soil is saline, crop residue can be left on the field, to trap snowfall, which will be used as soil moisture, when the snow melts. This will prevent soil from blowing or washing away. Also, for saline soils, salt tolerant and deep-rooted crops could be grown. A snow fence could be built, to trap moisture from snowfall as snow melts. To prevent erosion, again leaving cut stalks, or crop residue, or crops on the field will prevent soil erosion. Bind the roots together, absorb rain, protect the soil, and prevent tillage. Cover cropping can also be used - this is the growing of a green crop, to protect the soil, and if this is ploughed into a field, it will increase the soil's organic content. Crop rotations (letting some land lie fallow) will improve the quality of the soil. Structure. With less organic matter in a soil (deforestation) nutrient levels reduce and soil quality decreases. Growing leguminous crops, such as peas, beans, soy, or clover will increase the nutrients in a soil, so it requires less fertilizer for the next crop. Strip cropping or growing alternate crops at right angles to the wind, will reduce the effect of wind. Also, leaving a shelter belt of trees, bushes, or cut stalks will reduce the effect of wind speed on the soil.

Example candidate response – high, continued

Question	Part	
		<p>In a natural ecosystem, a mat of decomposing grass will increase a soil's organic content. However, if it is removed, soil will erode. One example of ^{the north part of west} sustainable farming is witnessed in Burkina Faso, in Africa.</p> <p>The Sahara was expanding southward (desertification) and populations were increasing, which put increased pressure on the land to produce food. Droughts were increasing, and cattle and goats were moving southward to find grazing lands, but this was where farmers were growing crops. Rainfall was low and flash floods were increasing, making farming difficult. The land no longer had time to lie fallow - farmers used to farm for a year, and let their land lie fallow for 8, so it could absorb precipitation as soil moisture. However, due to the increase in population, cropping was continuous, and crop yields were falling. In 1979, Oxfam worked with local farmers.</p> <p>They developed the process of placing stone lines along the contour lines of slopes. On shallow slopes, it was difficult to find the contour line, so a transparent flexible hosepipe was used, so water finds its own level, it was filled with water, and when the water levels on each end aligned, the stones were placed accordingly. This means that now north of Burkina Faso is covered in stone lines - it takes up 1 to 2% of all cropping land. Now trees can be grown, and seeds can germinate in moist, organic, nutrient rich soils. Also, the stone lines trap the rainfall, dead leaves, organic matter, and debris that would have previously run off the slopes. Therefore, if soil has been degraded, there are many ways to repair and restore it.</p>
		<p>good range of biology. Good knowledge described. Covers all aspects, though slight evaluation. level 4</p> <p style="text-align: right;">24 (33)</p>

Examiner comment – high

5(a) An example of a very good part **(a)** answer.

5(b) This is an example of a good essay for part **(b)** with a good range of examples demonstrating a good knowledge and understanding. The answer covers all aspects of the question, though lack of substantial evaluative comments prevent access to the highest marks.

Total mark awarded = 33 out of 40

Example candidate response – middle

5. a) soil is formed in many areas of the world with many different factors involved. For example, the soil in a rainforest has a huge amount of ~~parent~~ material to grow from as there are so many organisms that die and leaves that drop every day. There is also a lot of rainfall, and very little light on the forest floor, the factors that aid in organisms decomposing the soil. The climate nurtures decomposition and decomposers. These factors would suggest high nutrient soil, however it is not, because there is very little time for the massive amount of plants in the forest absorb the nutrients as they are available, leading to surprisingly poor quality soil. And in typically too.

4

Example candidate response – middle, continued

5b) Deforestation is always bad for the environment, specifically because of erosion and deterioration. Trees have expansive root systems that physically keep the soil grounded. They also provide shade, which helps prevent over-drying of the soil and then nutrient loss, or loss of decomposition. The trees' leaves, leaf litter and branches also protect against harsh wind and rain causing erosion elsewhere. The roots also help prevent wind and water erosion.

Soil quality is always important to maintain in agriculture, otherwise more land will be needed, the environment will be destroyed, and people will go hungry. There are many ways to manage soil quality. One is by simply fighting erosion by planting trees every few rows of crops in order to break wind and runoff. Another way to do the same thing is to plant a taller plant to a crop alternating with a smaller one. Another important aspect

Example candidate response – middle, continued

of sustainably increasing soil quality through crop rotation. A very old practice that simply involves rotating the crops grown in a field with a new one ~~in~~ the next year, often providing a year break to regain the nutrients. This technique is used because certain plant species can deplete the soil of specific nutrients, while others don't need as much of that nutrient. Crop rotation leads to healthier crops and healthier soil in the long run.

Organic fertilizers are often a good idea as well. These fertilizers can come in the form of animal feces, and recycle nutrients right back into the soil.

One valid developed point.

Land use methods of soil management
level 2

20

24

Examiner comment – middle

5(a) In this case a weaker section **(a)** response is supported by a better section **(b)** response. In section **(a)**, the candidate has chosen to describe the rainforest soil. Key words from the diagram are emphasised but the supporting text is not particularly detailed and does not access the higher levels. This is an example of a candidate who recognises the concepts involved but is not confident with the knowledge.

5(b) A reasonable response to the question with some valid developed points made and methods of prevention considered. In order to develop further and access the higher levels the candidate would need to include some evaluative comments and to include some named examples of deforestation.

Total mark awarded = 24 out of 40

Example candidate response – low

Question
number

5b	<p>Deforestation can result in soil erosion and deterioration. For example</p> <p>eg On the United States deforestation has caused many problems that include soil erosion and deterioration.</p> <p>Since the United States is an MEDC, construction and tourism is a big factor of the country. Many trees</p> <p>eg such as mangroves were cut down near the coast ^{of Florida} in order to build hotels</p> <p>and different buildings to attract tourists. This affected the environment very negatively since mangroves were used to filter the CO₂ in the air.</p> <p>Mangroves also have very strong roots which were used to hold the soil in place and keep it from eroding from the coast. United States being an MEDC, it is more Since the United States is an MEDC the majority of it is cities, which consist of many buildings and not much vegetation.</p> <p>However vegetation is important because the roots are what hold the soil in place. They also help filter the water and prevent flooding. When the soil is kept in place by the vegetation it absorbs many of the much of the heat in that area. However in New York a lot of that heat is trapped in the surface since there is not</p>
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Example candidate response – low, continued

Question number		
	<p>a lot of vegetation.</p> <p>Soil quality can be sustainably managed for agriculture. For example using silt instead of clay or sand will ensure that the plants will have enough water without flooding. Using this type of soil will also allow a greater amount of organism to live in the soil. Opening up different areas strictly for agriculture will allow soil quality to improve since it will not be disturbed or polluted. Avoiding over planting over planting or planting too much in a single area can stress out the soil causing it to not be fertile enough for the crops planted.</p>	<p>23 17,</p>
<p>5a</p> <p>eg</p> <p>yes</p> <p>yes</p>	<p>Vegetation is important in order to prevent soil erosion, deterioration, and improve the quality of the soil.</p> <p>Sand is usually found on the coast since it is not as efficient of holding water since it is so loose. Water usually passes right through sand. Sand is home to many sea animals since it is usually near the coast. Since sand is very loose it is prone to soil erosion that are usually caused by tsunamis and earthquakes. Since sand is near the coast it is also prone to pollution from tourists.</p>	<p>but focuses effectively on the question!</p> <p>21</p> <p>19x</p>

Examiner comment – low

- 5(a)** This candidate answers part **(a)** after part **(b)** suggesting the essay choice was made on part **(b)** alone. This is borne out by the lack of a valid named soil and few relevant references to the figure upon which part **(a)** is based.
- 5(b)** The candidate uses examples and considers aspects of soil management issues but some of these are not clear, some erroneous points were made and relevant key ideas were missing, such as terracing, intercropping, mulches and rotation. It also lacks evaluation.

Total mark awarded = 19 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

