Specimen Paper Answers

Cambridge International AS & A Level

Cambridge International AS & A Level Geography

9696

For examination from 2018

Cambridge Advanced

CAMBRIDGE International Examinations

Version 1

A DIVISION OF
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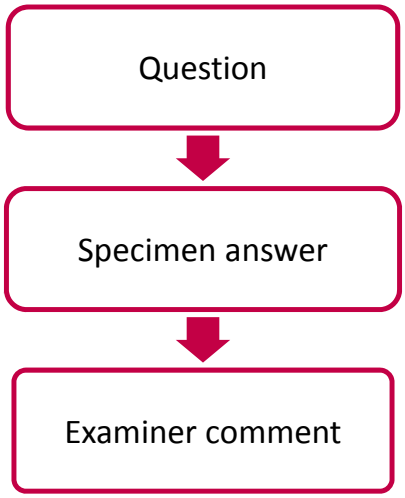
Contents

Introduction

The main aim of this booklet is to exemplify standards for those teaching Cambridge International AS and A Level Geography (9696), and to show examples of high grade answers.

This booklet contains answers to the 2018 Specimen Papers 1, 2, 3 and 4, which have been marked by a Cambridge examiner. Each response is accompanied by a brief commentary explaining the strengths and weaknesses of the answers.

The following format for each paper has been adopted:



Each question is followed by an example of a high grade answer 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.

The mark schemes and inserts for the Specimen Papers are available on our Teacher Support at **https://teachers.cie.org.uk**

Assessment at a glance

For Cambridge International AS and A Level Geography, candidates:

- take Papers 1 and 2 only (for the Cambridge International AS Level qualification)

or

- follow a staged assessment route by taking Papers 1 and 2 (for the Cambridge International AS Level qualification) in one series, then Paper 3 and 4 (for the Cambridge International A Level qualification) in a later series

or

- take Papers 1, 2, 3 and 4 in the same examination series, leading to the full Cambridge International A Level.

Component	Weighting	
	AS Level	A Level
Paper 1 **1 hour 30 minutes** **Core Physical Geography** Section A: Three data response questions (30 marks) Section B: One structured question from a choice of three (30 marks) 60 marks	50%	25%
Paper 2 **1 hour 30 minutes** **Core Human Geography** Section A: Three data response questions (30 Marks) Section B: One structured question from a choice of three (30 marks) 60 Marks	50%	25%
Paper 3 **1 hour 30 minutes** **Advanced Physical Geography Options** Candidates answer questions on two of the optional topics Each topic consists of one structured question (10 marks) and a choice of essay questions (20 marks) 60 marks	-	25%
Paper 4 **1 hour 30 minutes** **Advanced Human Geography Options** Candidates answer questions on two of the optional topics Each topic consists of one structured question (10 marks) and a choice of essay questions (20 marks) 60 marks	-	25%

Paper 1 Core Physical Geography

Section A (30 marks)

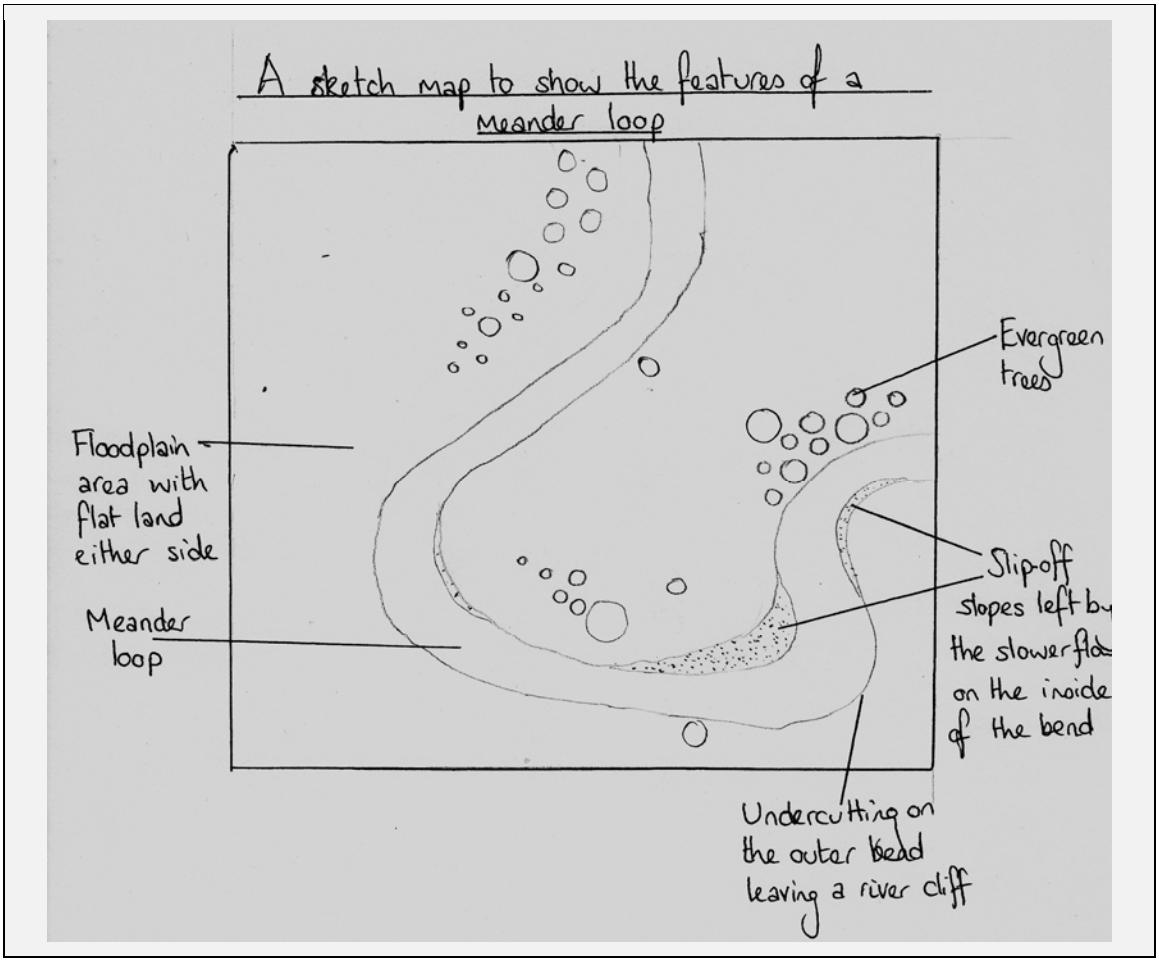
Answer **all** questions in this section. All questions carry 10 marks.

Specimen answers

Hydrology and fluvial geomorphology

1. Photograph A shows a meandering river.

a) Draw a sketch map of the meander in Zone X in Photograph A. Label the main features. [4]



b) Explain the formation of **one** feature you identified in (a). [3]

Meanders form due to areas of deeper and shallower water in the river's middle course, called pools and riffles. These pools and riffles interact with the flow of the water in this part of the rivers course, causing the fastest flow (thalweg) to swing from one side of the river to another. Erosion is caused on the outside of the bend where the current is fastest which produces the river cliff. By contrast deposition occurs on the inside of the bend where the current slows, forming the slip off slope. This differential movement of water leads to the development of helicoidal flow which accentuates the erosion and deposition.

c) Using photograph A, suggest how the river might change course. [3]

The meanders in photograph A could be further exaggerated due to erosion on the outer bank and deposition on the inner. This would further accentuate their already very curved shape. This will mean that eventually the neck of these meanders is broken through, often in a time of flood, leading to the river taking the quicker, straight route across the neck. This leaves behind the cut-off meander loop which becomes an oxbow lake.

Examiner comment

Questions 1(a)
An accurate sketch map with a range of river features correctly located and labelled.

Mark awarded = 4 out of 4

Question 1(b)
Meanders are not easy to explain but this candidate focused on formation and development with an appreciation of the specific processes of erosion and deposition. The answer specifically relates to feautres identified in Part (a), which is the main emphasis of the question. The answer shows a good understanding of cause and effect. A diagram would have made the explanation even more effective.

Mark awarded = 3 out of 3

Question 1(c)
Clearly the candidate understands the mechanism of meander movement and has extended this to the conclusion of oxbow formation. Again the task would have been easier if diagrams had been used to illustrate the development of the meander.

Mark awarded = 3 out of 3

Atmosphere and weather

2. Fig 1. shows the temperature at midnight across an urban area.

a) Using Fig. 1, identify:

(i) the location of the maximum temperature; [1]

The maximum temperature occurs over the CBD.

(ii) the value of the minimum temperature. [1]

The minimum temperature is 24°C.

b) With reference to evidence from Fig. 1, describe the relationship between land-use and temperature shown. [3]

Urban temperatures are highest in the CBD, between 27.5°C and 28.4°C. These temperatures decline westwards and more sharply eastwards as you move into the outer residential areas. To the west of the CBD, a temperature plateau occurs over the industrial zone where temperatures drop to 27.5°C and then rise again to 28.8°C before decreasing steadily in the inner and outer residential areas to 25.5°C. To the east, temperatures decrease more rapidly to 24.0°C.

c) Explain why night time temperatures vary across an urban area such as the one shown in Fig.1. [5]

Night time temperatures will be higher in the CBD because larger quantities of heat are absorbed by surfaces such as brick, concrete and tarmac. During the day these surfaces absorb heat and slowly release it again at night as a result of the low albedo of such surfaces. In the CBD there are much greater concentrations of these types of surfaces to absorb heat during the day and then release it again slowly at night than in the surrounding residential and industrial areas. In addition, anthropogenic sources of heat such as lighting, air conditioning units, vehicles etc. are concentrated in the busier CBD. This heat is once again released slowly at night, causing temperatures to remain higher in the CBD than in the surrounding residential areas.

Examiner comment

Questions 2(ai) and 2(aii)
Both correct

Mark awarded = 2 out of 2

Question 2(b)
Good reference to the resource, with both specific land-uses and temperatures quoted. The candidate recognises the west/east contrast and the role of industrial versus residential land-use.

Mark awarded = 3 out of 3

Question 2(c)
This candidate gave a good explanation of why night time temperatures are higher in the CBD, quoting a range of factors using the correct terminology, e.g. albedo. Without the last sentence linking the reasons why temperatures vary across an urban area, this answer would not have scored full marks.

Mark awarded = 5 out of 5

Rocks and weathering

3. Fig. 2 shows types of weathering, rainfall and temperature.

a) **(i)** Identify the main type of weathering occurring at **A**. [1]

The type of weathering occurring at A is strong chemical.

(ii) Identify the main type of weathering occurring at **B**. [1]

The type of weathering occurring at B is strong physical.

b) With reference to evidence from Fig. 2, describe the relationship between temperature and type of weathering. [4]

As the temperature on figure 2 falls, the type of weathering changes from chemical (which stops at around -1°C) to physical (which only occurs below 6 °C). Chemical weathering is strongest between 9 and 30 °C where there is also high rainfall.

c) Explain the role of water in **one** weathering process. [4]

One form of physical weathering is freeze-thaw weathering. In this process rain water seeps into cracks in rock faces and then freezes solid when temperatures fall below zero, often at night time. As the water freezes, it takes on a crystalline form which increases its volume by as much as 9%. This expansion means that more pressure is placed on the rock and the original crack expands. Overtime this process is repeated and as the crack expands more water can enter allowing the volume of ice to increase further, pushing the crack apart. Eventually the crack becomes large enough that sections of the rock can break away.

Examiner comment

Questions 3(ai) and 3(aii)
Both answers are correct.

Mark awarded = 2 out of 2

Question 3(b)
This is a concise answer that directly answers the question of relationship. Data is accurately quoted from the resource to demonstrate the change from chemical to physical weathering as temperatures fall. By itself this would have gained three marks but the candidate goes on to state that temperature also affects the strength of chemical weathering.

Mark awarded = 4 out of 4

Question 3(c)
A very well-explained weathering process with a clear link to the role of water as an expansion agent with respect to freeze-thaw weathering. This candidate explained both the freeze and thaw parts of the process. There are several other wreathing processes that could have been used, but the question only requires one to be discussed.

Mark awarded = 4 out of 4

Section B (30 marks)

Answer **one** question from this section. All questions carry 30 marks.

Specimen answers

Hydrology and fluvial geomorphology

4) a) **(i)** Define the hydrological terms *overland flow* and *infiltration*. [4]

Overland flow (also known as surface runoff) is water that flows over the land's surface because precipitation exceeds the infiltration rate or the soil is saturated. Infiltration is the process by which water soaks into or is absorbed by the soil in a downwards movement.

(ii) Briefly describe the process of transpiration. [3]

Transpiration is the process by which water vapour moves through a plant, and escapes into the atmosphere, as water vapour. This is through the stomata of the plants leaves.

b) Explain how rock type and soils can affect stores of water in a drainage basin. [8]

There are numerous stores of water within the drainage basin including soil water, surface water and groundwater. With respect to soils clay soils have a relatively high porosity (40-70%) and do absorb much water, but this takes time due to the small pore size. Therefore, surface storage on clay soils is likely to be higher. Sandy soild absorb water much more quickly which means surface water stores are more limited. The stores of water are also affected by the nature of the underlying rock although in most cases there is a thickness of soil above the rock layers. With respect to rock, there is both primary and secondary permeability and porosity. For example, granite is impermeable but has an extensive joint network, though these joints become tightly closed at depth. Impermeable rocks and soils reduce infiltration therefore creating greater temporary surface storage and leading to faster movement of precipitation to rivers, resulting in channel storage. In contrast, permeable rocks (such as sandstone) and soils (such as sandy soil) absorb water easily, so surface run-off is rare. The underlying bedrock plays a major role in water stores and if this is a permeable and porous rock, such as sandstone, water will be able to percolate through into the groundwater and be stored there. This is where 96.5% of all freshwater is stored.

c) With the aid of examples, discuss the view that river floods cannot be prevented but their effects can be reduced. [15]

The fact that river floods are still one of the most common of all environmental hazards supports the view that they cannot be prevented. Having said this, most urban areas in HICs are now able to manage and control small-scale regular flooding. However, they are still ill-equipped to deal with the low-frequency but high-magnitude events that occur. The idea of whether floods can be completely prevented is a complex one, particularly when the cost of management versus frequency of events plays such an important role in deciding which flood amelioration techniques are used. In Brisbane, Australia in the 1980s the Wivenhoe dam (a form of hard engineering) was built in response to a devastating flooding in 1974. This dam was effective in ameliorating flooding over the following 30 years but in 2011, poor management of water release following prolonged heavy rainfall led to a more serious flood event. This supports the idea that flooding cannot be fully prevented and that human interference can make flooding more extreme. Soft engineering techniques such as the Kissimmee River restoration scheme in Florida is an example of how the damaging impacts of hard engineering strategies like channelisation (which in this case exacerbated large scale flooding and had significant environmental impacts) can be reversed. The restoration has restored the natural environment and has allowed for controlled flooding in managed areas but has not prevented it fully. Land-use zoning can arguably be the most effective method of preventing damage from flooding by not allowing new development within one in 100 year flood areas. This significantly reduces the socio-economic cost of most flood events and is a practice used effectively in America. Again, this technique does not prevent flooding and instead ameliorates the effects suggesting that river floods cannot be completely prevented although there effects can be greatly reduced depending on the types of engineering put in place.

Examiner comment

Questions 4(ai)
Both terms are accurately defined.

Mark awarded = 4 out of 4

Question 4(aii)
Accurate description and good use of the technical term *stomata*.

Mark awarded = 3 out of 3

Question 4(b)
This is a very effective answer that considers the effects of both rock type and soil. This is well illustrated by a range of examples of both. The candidate demonstrates a good knowledge of stores in the drainage basin, with a clear understanding of how these stores are influenced by different rock and soil types. This candidate went beyond the obvious and linked them to channel storage. There was good use of appropriate technical terms throughout. The use of diagram(s) would have made the explanation easier.

Mark awarded = 8 out of 8

Question 4(c)
The candidate clearly appreciates the difference between prevention and managing the effects of flooding, although more could have been illustrated of the latter, especially with respect to examples of hard and soft engineering. There is more to land-use zoning, such as afforestation, changes of land-use practices, than discussed in the answer. This slightly restricts the marks that can be awarded. Examples were varied and a range of prevention/modification strategies were discussed. The strength of this answer lies in its focus on the question and appreciation that cost might be a controlling factor, as well as its recognition that extreme events would always pose a threat. There was a clear conclusion that related back to the question.

Mark awarded = 13 out of 15

Atmosphere and weather

5) a) **(i)** Briefly describe how some incoming solar radiation is prevented from reaching the earth's surface. [3]

About 16% of incoming solar radiation is absorbed by water vapour, dust and carbon dioxide effectively preventing it from reaching the earth's surface. About 20% is reflected back into the atmosphere by clouds while some is scattered by dust and pollution particles and as such is prevented from reaching the earth's surface.

(ii) Briefly explain why some surfaces absorb more solar energy than others. [4]

Surfaces that are dark in colour such as forests and vegetation absorb more solar energy than light coloured surfaces such as snow or large masses of light coloured sand. This degree of reflectivity is known as albedo. In surfaces with high albedos they reflect most of the incoming solar radiation, and only absorb a small amount. As well as colour playing a role, the degree of surface reflection is also important. Shiny surfaces such as snow and some bodies of water are reflective and so absorb less solar energy, while duller surfaces such as vegetation tend to absorb more.

b) Describe and explain how temperatures are influenced by distance from the sea. [8]

Land and water have different thermal properties; land heats and cools more quickly than water. Because of this, water takes up heat and gives it back more slowly than the land. In winter, in mid-latitudes, sea air is much warmer than the air over the land, so onshore winds bring warmer temperatures to the coastal lands. However in summer, cooler sea breezes over coastal areas cause coastal temperatures to be cooler than inland. This means that places closer to the sea have their temperatures moderated by the sea, while places further from the sea have more extreme temperature in both summer and in winter. This can be seen in average summer temperatures for Glasgow and Moscow, both on similar lines of latitude. Glasgow experiences an average summer temperature of 15°C compared to Moscow at 19°C with average winter temperatures for Glasgow 3°C compared to Moscow -8°C.

c) 'Global warming is caused as much by individual people as by large organisations.'
With the aid of examples, how far do you agree? [15]

One of the main causes of global warming is the increased amounts of carbon dioxide, methane and other greenhouse gasses in the atmosphere. While all of these gases appear naturally, their concentrations are being increased due to human activity, which is causing an enhanced greenhouse effect leading to global warming. The main human sources of greenhouse gas emissions are: fossil fuel use, deforestation, intensive

livestock farming, use of synthetic fertilizers and industrial processes. Both individuals and large organisations contribute to this. By using electricity generated from fossil fuel power stations; burning gas for heating or driving a petrol or diesel car every person is responsible for the carbon dioxide emissions that contribute to global warming. In addition, every product or service that humans consume indirectly creates carbon dioxide emissions as energy is required for their production, transport and disposal. However, the impact of large organisations on global warming far outweighs the impact of individuals. Deforestation is a major contributor to global warming and cattle farming is now the biggest threat to the remaining Amazon rainforest, a fifth of which has been lost since 1970. Big ranches are blamed for 80% of all deforestation in the region; the number of cattle in the Amazon grew from 21m in 1995 to 56m in 2006. Many large international organisations buy beef raised in the rainforest and thus directly support their actions which contribute to global warming. In addition, an analysis from the journal of Climatic Change found that between them, just 90 companies on the list of top emitters produced 63% of the cumulative global emissions of industrial carbon dioxide and methane between 1751 to 2010. All but seven of the 90 were energy companies producing oil, gas and coal; the remaining seven were cement manufacturers. These companies include Chevron, Exxon, BP, and Royal Dutch Shell and coal producers such as British Coal Corp, Peabody Energy and BHP Billiton. These large organisations therefore have a much bigger impact on global warming than individuals.

Examiner comment

Questions 5(ai)
Three clear ways are given showing why radiation may not reach the Earth's surface. The use of data further supported the candidate's points.

Mark awarded = 3 out of 3

Question 5(aii)
This candidate has a clear appreciation and understanding of the nature of albedo. Two aspects (colour and shininess) were well explained, developed and exemplified.

Mark awarded = 4 out of 4

Question 5(b)
The explanation was sound, with some of the main reasons given for the contrast between sea and land in their relative capacities to absorb and retain heat. It is the balance between the two aspects of the question that makes this answer effective. Again, a diagram would have aided the explanation.

Mark awarded = 8 out of 8

Question 5(c)
The candidate clearly understands the causes of global warming and the range of contributions to greenhouse gas production made by individuals, companies and governments. The strength of this answer lies in the range of examples used, both at the company and government level, as well as the acknowledgement that global warming might be a natural phenomenon. This answer typifies the highest band due to the discursive nature of the answer and the effective conclusion which revisits the statement quoted in the question.

Mark awarded = 15 out of 15

Rocks and weathering

6) a) **(i)** Define the tectonic terms *volcanic island arc* and *ocean trench*. [4]

Volcanic island arcs are a series of volcanic islands which form in an arc shape parallel to, but between 150km-200km from the plate margin. The plate margins which create these formations are ocean-ocean subduction zones. An example is the Lesser Antilles arc. Ocean trenches are long and narrow depressions in the ocean floor with depths from 6000m to 11000m. They are found at destructive plate margins where subduction occurs, drawing the surface of the plates down which creates the trench. An example is the Mariana Trench in the Pacific Ocean near Guam.

(ii) Briefly describe the process of sea floor spreading [3]

Sea floor spreading is the process that occurs at constructive plate margins such as the Mid-Atlantic Ridge. Here, due to divergent convection currents the oceanic crust is pulled apart. This movement reduces the pressure on the mantle, allowing melting to occur and magmas to form and rise into the spaces created. This basaltic magma then cools to form new oceanic floor. Due to the continuing divergence of the plates the age of the oceanic crust increases away from the ridge in a similar pattern on both sides of the margin.

b) Describe and explain the formation of fold mountains. [8]

Fold mountains are mountain ranges that have been folded, faulted and uplifted because of the convergence of tectonic plates. This convergent plate movement results in the thickening of the crust. This is because the colliding plates override one another, creating folds and thrust faults which allow the continental crust to form in stacking sheets known as thrust sheets.

At continent-continent collision zones fold mountains are built because the buoyant continental crust cannot subduct. This means that the compressive forces operating are translated into the deformation and thickening of the crust as a result of intense folding and thrust sheets. This has occurred where the Indo-Australian plate moved north eastwards to collide with the Eurasian plate, creating the Himalayas. In the case of continental collision areas like the Himalayas, the addition of oceanic material can also contribute to crustal thickening. What was the sediment that formed at places like the accretionary wedge and passive margins of the Tethys ocean were incorporated as ophiolites as remnants of the oceanic basin was preserved between the two continents as they were uplifted. In some cases the pressures and temperatures that occur during the process of continent-continent collisions are capable of forming magmatic

intrusions. These are usually granitic in composition but do not contribute significantly to mountain building.

At ocean–continent subduction zones, denser oceanic crust is subducted underneath the lighter, less dense continental crust. As the continental crust is not subducted, it has to absorb the compressive forces by deformation, once again creating folds and thrust sheets. This has occurred where the Nazca and South American plates meet to form the Andes. Here active volcanic activity also contributes to the formation of the fold mountains due to the production of volcanic material like deep granitic intrusions and andesitic magmas. As well as this magmatic material the subduction process also creates an accretionary wedge where sediments are intensely folded and faulted as they are squeezed against the continental margin. These sediments contribute to the outer parts of the mountain on the side parallel to the ocean basin.

c) With the aid of examples, assess the extent to which human activities can affect the stability of slopes. [15]

The stability of slopes can be affected by human activities such as construction, excavation and drainage. Most changes that humans make to slopes are minor and localised in relation to the scale of the natural land surface. Human interference with slopes generally tends to speed up naturally occurring processes, rather than creating new features. In this respect, the impact of human activities on the stability of slopes can be considered to be low. However, in urban areas, slopes are often modified to construct roads and buildings especially where settlement is dense and there is a shortage of land. In these cases, attempts are usually made to prevent mass movements – for example by pinning to attach wire netting, or by re-profiling the slope to create small terraces that are more stable. In Hong Kong, landslides are frequent due to high rainfall, the steepness of the slopes and the density of settlement, a combination of human and natural factors. Between 1947 and 1997, more than 470 people died as a result of landslides. Most landslides here have been attributed to inadequacies of hillside construction works and deficiencies in maintaining slopes once they are utilised. Clearly, in these cases, the modification of the slopes and the fact that the slopes are densely settled means that the human impact on the stability of slopes is significant.

Examiner comment

Questions 6(ai)
Two well-defined terms. The use of examples further enhanced an already effective answer. The points were well related to plate movement.

Mark awarded = 4 out of 4

Question 6(aii)
The candidate gives a correct description, with good use of technical terms such as basaltic magma.

Mark awarded = 3 out of 3

Question 6(b)
A sound description of the formation of fold mountains, although it would have benefited from diagrams. The explanation recognised the nature of plate margins, direction of movement, the role of accretionary wedges and the folding process. This was a well-exemplified answer which demonstrated good knowledge of the technical terms. There was no expectation that the associated faulting and volcanic effects had to be included but this did demonstrate the candidate's understanding of the processes.

Mark awarded = 8 out of 8

Question 6(c)
The key to this question is an understanding of what makes a slope stable or unstable. This candidate clearly understands the interplay of slope stress and slope strength, although perhaps this could have been more developed with some examples. The candidate produced a well-structured and balanced answer looking at how human activities could decrease stability or increase it. A range of examples were used to illustrate the ways in which various human activities alter the stability of slopes. Again, diagrams would have made their role clearer. This answer is placed in the top band owing to the level of assessment, which is typified in the effective conclusion which referred back to the wording of the question.

Mark awarded = 15 out of 15

Paper 2 Core Human Geography

Section A (30 marks)

Answer **all** questions in this section. All questions carry 10 marks.

Specimen answers

Population

1. Fig. 1 shows the percentage of married women using modern contraception ant the total fertility rate, by country, in 2012.

a) State the total fertility rate for India shown in Fig. 1. [1]

The total fertility rate for India is 2.9.

b) Describe the relationship between the two variables, using data from Fig. 1. [4]

The data shows that there is a strong negative relationship between the total fertility rate and the percentage of married women using modern contraception. The higher the percentage of married women using contraception, the lower the total fertility rate. For example in the USA 90% of married women use modern contraception, compared to their total fertility rate of 2.2, while in India, 45% of married women use modern contraception, resulting in a total fertility rate of 2.9. There are however, anomalies, such as Bosnia-Herzegovina where 9% of married women use contraception but there is a low fertility rate of 1.9.

c) Explain **three** factors, other than contraception, which influence fertility rates. [5]

Education is a key factor in reducing fertility rates. Where girls attend school and female literacy is high, fertility rates are often lower as educated women have better knowledge about birth control, a greater social awareness and want careers. This means they often put off having children until later in life, and also have fewer children per family. This has a direct impact on reducing fertility rates. Religious beliefs also influence fertility with both the Roman Catholic and Islamic faiths being opposed to birth control. Where this is the case, fertility rates will be higher. Finally, political influences such as governments who support pro- and anti-natal policies influence fertility rates by supporting or enforcing policies that make it easy or difficult to control family size.

Examiner comment

Question 1(a)
Correct: a range of 2.8 – 3.0 was allowed.

Mark awarded = 1 out of 1

Question 1(b)
This is a very good answer that meets all the requirements of a question asking candidates to consider a relationship in the data. It refers to the strength and direction of the relationship, supporting this with examples from the data. The candidate also identifies anomalies that do not fit the overall trend.

Mark awarded = 4 out of 4

Question 1(c)
This answer includes three clear and appropriate factors with some development. The first point is well-developed into cause and effect on fertility and is exemplified. The next two points are not as well-developed but include enough.

Mark awarded = 5 out of 5

Migration

2. Fig. 2 shows an extract from a news website about asylum seekers who arrived in Australia by boat in 2010. Asylum seekers who receive official permission to stay in a country are called refugees.

a) According to Fig. 2, which country was the origin of the greatest number of asylum seekers? [1]

The greatest number of asylum seekers were from Afghanistan.

b) Describe the distribution of source areas of asylum seekers shown in Fig. 2. [4]

The distribution of source areas for asylum seekers were from LICs in South East Asia and the Middle East with the largest number being 2706 from Afghanistan. Iran (883), Iraq (636) and Sri Lanka (537) were also the source areas for a large number which could be attributed to the fact that there is unrest in these countries. There are also a further 650 asylum seekers who are classified as other, the fourth largest grouping. This group may be due to a lack of information about their country of origin.

c) Suggest reasons why Australia, an HIC, may be an attractive destination for asylum seekers. [5]

Australia may be an attractive destination to asylum seekers due to economic factors such as its status as an HIC. This means that people may perceive that they will be able to have a better quality of life there. Australia is also a politically stable country which is not involved in any global conflict meaning that asylum seekers may see it as a suitable place to seek safety when escaping from a war-torn country or one where there is political unrest. Additionally, asylum seekers may have heard from previous migrants that healthcare and education are better in Australia, providing a social reason for them to attempt to reach the country.

Examiner comment

Question 2(a)
Correct

Mark awarded = 1 out of 1

Question 2(b)
This answer contains good use of data from the resource and a number of features of the distribution are correctly identified. These include the points that the countries tend to be LICs, there are a few large contributors and their distance to Australia plays little part in the distribution. Although no explanation was required, the idea of areas with unrest did help the description.

Mark awarded = 4 out of 4

Question 2(c)
This answer includes a range of appropriate pull factors covering economic, social and political reasons, with some development.

Mark awarded = 5 out of 5

Population/Migration/Settlement dynamics

3. Fig. 3 shows the development of Seoul urban region, South Korea, between 1970 and 2000.

a) Using Figs. 3A and 3B, identify **two** changes to Seoul between 1970 and 1980. [2]

Between 1970 and 1980 Seoul's built-up area has expanded to the south side of the Han River and three new expanded towns have developed here as well (Puchon, Anyang and Seongnam).

b) Describe Seoul urban region as shown in Fig. 3C. [3]

Seoul's urban region by 2000 is more heavily developed on the south side of the Han River with nine expanded towns as well as Inchon that lies on the boundary of the river. There are four new towns by 2000, including Pundang and Ilsan, and three of these are also in the south. There has been urban renewal occurring within the built-up area inside the greenbelt and three quarters of this has been north of the Han River.

c) The population of Seoul decreased from 10.4 million in 2000 to 9.8 million in 2010.
Suggest reasons why the total population of some cities is decreasing. [5]

The population in some cities, such as Chicago in America and Seoul in South Korea, is decreasing due to a number of reasons like the social push factor of higher crime rates in urban areas. This leads to people, particularly those with families, moving out to rural areas in the process of counter urbanisation. Another reason is linked with overall population decrease in a country due to a decline in fertility rates from stage three onwards in the demographic transition model, as is happening across Italy and in a number of their cities, such as Venice. An economic push factor is the high cost of living in urban areas combined with the improvements in cost and speed of transport connections meaning that it is financially viable for people to move to rural areas and commute to their place of work.

Examiner comment

Question 3(a)
Two clear changes are identified and well supported with data from the resource.

Mark awarded = 2 out of 2

Question 3(b)
A number of clear descriptive points are made and supported with data from the resource.

Mark awarded = 3 out of 3

Question 3(c)
This answer goes beyond simple urban push and rural pull factors to cover the role of declining fertility. There were brief examples and each of the causes had some development. There are other issues that could have been discussed that might be more important than crime rates such as de-industrialisation and congestion/pollution.

Mark awarded = 5 out of 5

Section B (30 marks)

Answer **one** question from this section. All questions carry 30 marks.

Specimen answers

Population/Migration

4. a) **(i)** Describe the changes to the death rate in the demographic transition model. [3]

Death rates are high and fluctuating in stage one of the demographic transition model and start to fall and then continue to fall steadily through the whole of stage 2. Death rates continue to remain low and stabilise in both stage 3 and stage 4. Death rates increase slightly in stage 5 of the demographic transition model.

(ii) Suggest reasons for the changes to the death rate you described in **(a) (i)**. [4]

Death rates are high in stage 1 because of poor diet, regular famines and also because of a lack of hygiene, poor living conditions and poor medical care. Death rates start to fall sharply in stage 2 because of better living conditions, including access to clean water, better quality and more reliable food sources. Improved medical conditions, including vaccinations also help to reduce death rates. Death rates continue to decline and then stabilise in stage 3 and stage 4 as standards of living continue to rise. Death rates rise slightly in stage 5 as there is a growing ageing population.

b) With the use of examples, explain the advantages and disadvantages of using the demographic transition model to predict future population changes. [8]

The demographic transition model was developed as a descriptive model, based on observation of the industrialisation processes that occurred in Europe and North America. The stages of the model fit particularly well with some countries such as Singapore and South Korea who seem to be passing through the same stages of the demographic transition model as they become more developed, although this is occurring at a faster rate than Britain and USA. Additional advantages include the fact that the model is dynamic and can be used to show change over time and can be used to predict a sequence of development events. Disadvantages of this model include that it was based on the experiences of industrialising countries and is not as relevant to non-industrialising countries, many of whom continue to move through the stages because of support from industrialised countries (e.g. via food aid and immunisation programs). The model also assumes that all countries go through the same sequence of stages and doesn't account for events such as civil war and the HIV/AIDS epidemic or government initiatives such as China's One Child Policy which disrupts the sequence. Finally, the model had to be adapted to include a fifth stage to explain the decline in

the rate of natural increase when birth rates fell below death rates as has happened in some Western European counties and in Japan in the late 20th century.

c) With the aid of examples, assess the challenges for countries at Stage 5 of the demographic transition model. [15]

Countries at stage 5 of the demographic transition model experience a significantly ageing population as fertility decreases and life expectancy increases. Birth rates are lower than death rates, causing a negative rate of national increase. Japan, at stage 5 of the demographic transition model, has the highest median age in the world of 46 years. 33% of its population is over the age of 60. The Japanese work force peaked at 67.9 million in 1998 and has been in decline ever since. This causes a number of economic challenges. The declining work force may slow economic growth and may result in a shortage of workers in some sectors of the economy. A greater dependence on fewer tax payers results in reduced fiscal revenue meaning that it becomes harder to fund healthcare systems, public pensions and puts government budgets under pressure. Older people may need to work beyond the usual retirement age to make up for a pension deficit, leading to changes in the retirement age and legislation. In addition, increased demand on services like specialist geriatric care, hospitals and hospices require changes to care for the elderly and more carers and nurses will need training. This has an economic as well as social cost. More people will also need to act as unpaid carers to their own elderly family members, putting pressure on them socially and financially. Countries in stage 5 of the demographic model have to prepare for the economic, social and political implications of an increasingly aged population.

Examiner comment

Question 4(ai)
This answer had a clear and accurate description of the changing death rate and covered all stages of the demographic transition model. A diagram would have effectively supported the answer. The answer would have been further improved by using figures for the death rate, but there was sufficient description for full marks.

Mark awarded = 3 out of 3

Question 4(aii)
The candidate covers the stages, although most explanation is based on the change from stage 1 to 2. Other stages are explained with clear links to the changes in the death rate.

Mark awarded = 4 out of 4

Question 4(b)
This shows clear understanding of both the advantages and disadvantages of the model. A range of valid points are given and supported with some examples. It would have been good to include some indication that the candidate recognises that the DTM is a model and as such is simplification. However, there was enough coverage of both aspects of the question for full marks.

Mark awarded = 8 out of 8

Question 4(c)
This answer starts by explaining what stage 5 means for countries which reach this point. The candidate then goes on to consider the largely negative effects of an ageing population. The lack of a youthful age group is also considered. Both points are well explained with some exemplification. The conclusion is especially effective as it recognises the scale dimensions of this issue

Mark awarded = 15 out of 15

Migration/Settlement dynamics

5. a) Describe how obstacles, barriers and distance may influence the volume of internal migration. [7]

In countries with significant physical features, such as the Andes Mountains in Chile, these form natural barriers to migration due to difficulty with transport in the area. This can reduce internal migration or lead to migrants being funnelled along particular routes and to certain destinations. In Australia, air and road transport links are good but the sheer size of the country may constrain migration because of the distance from relatives and friends caused by relocating. Intervening obstacles such as political barriers can affect the volume of internal migration: if authorities within the country establish quotas for new residents in areas according to their skills or age then the volume of new migrants will be capped. Finally the distance of internal migration affects the volume as people often only migrate locally, to a larger property or nicer area, rather than across large distances.

b) Explain why pull factors in internal migration are often perceived rather than real. [8]

Pull factors of internal migration can be across a range of economic, environmental and social factors but the percieved improvements can be incorrect. Migrants often percieve that they will have a better quality of life in locations that they are pulled towards because stories have reached them of distant relatives or family acquaintances who have moved to new locations and are enjoying better health, educaion or lifestyles. This can be exaccerbated by media information about poor quality of life in rural areas and improvements in urban areas. In the slum settlement of Dharavi, Mumbai there are over 1 million residents and it is estimated that a further 300 families arrive in Mumbai every hour. Many of these people travel from the rural poor areas of India to the economic capital of the country in the hopes of finding employment. However, there is not enough formal employment for the volume of people arriving. In America aspiring actors want to move to Hollwood in Los Angeles because they expect to find paid acting work here as they have heard stories of people doing this, however in reality only a small proportion of the migrants will actually be successful in securing employment in the industry. From eastern Turkey people may migrate because the push factors to get away from neighbouring Syria are so extreme that they are not motivated by pull factors but by a desire to get to safety.

c) With the aid of examples, assess the extent to which the characteristics of internal migration change as a country develops. [15]

As countries develop, a number of changes in the characteristics of migration occur, some of which are more pronounced than others. The progression in the direction of

movement from rural–urban migration to urban–rural migration between LICs and HICs is one of the most distinct. In LICs such as Bangladesh the main migration stream is of the rural poor moving from culturally traditional areas where agriculture is the main form of employment, to cities such as the capital Dhaka where rapid change is taking place. A combination of push factors from the rural areas, such as the significant impact of flooding on crop harvest, and pull factors, like the envisioned prospect of a better paid job, are the main driving forces of this movement. In contrast, by the time countries have achieved a developed status, this trend often reverses as can be seen in the extensive suburbanisation and counter-urbanisation taking place in HICs such as England and particularly within Los Angeles in the USA. Counterurbanisation involves a population shift out of core industrial regions to peripheral rural areas as wealthy internal migrants seek a better quality of life for themselves and their families, away from issues in urban areas. This is supported by the progression of transport and technology in these HIC countries, allowing migrants the option to work from home or to commute back into urban areas for work. Interestingly, a number of other factors directly link to this central reason for migration patterns, including age; gender; wealth and education. In LICs and MICs it is often young, working age people and particularly men, who migrate to urban areas to find work. This has been seen in south-east Turkey where many young men migrate to tourist areas in the hope of finding work on a seasonal basis, often returning home for the winter season. This pattern of young people migrating can still be seen in HICs from some rural areas with young adults between 20 and 30 years old choosing to migrate to urban areas for work. The more noticeable movements in these countries include the retired generation actively seeking to settle in rural communities, such as Devon in England, as well as adults with young families and those approaching middle age opting to take advantage of the greater space available and higher quality of life in rural areas. This is not a pattern that is seen in LICs and HICs. It is clear that as a country develops, the characteristics change significantly and the direction of movement, alongside the wealth of those moving, both stand out as particularly significant. However it is also apparent that it is very difficult to separate factors from one another with a number often overlapping.

Examiner comment

Question 5(a)
This answer covers all three aspects – obstacles, barriers and distance, and offers examples of where they influence the volume or direction of migration. It is clear the candidate recognises the causes and effects of migration. The notion that the nature of the migrant or the level of technology might impact on the barriers to migration could have been explored but there is enough coverage to gain full marks.

Mark awarded = 7 out of 7

Question 5(b)
The candidate offers a wide range of reasons why perception of pull factors is rarely an accurate reflection of reality. There are supporting examples, although these could have been more developed in places. The last point concerning extreme push factors was not well developed but was valid. The range of coverage is sufficient for full marks.

Mark awarded = 8 out of 8

Question 5(c)
This answer would have benefited from an initial definition of internal migration. A range of aspects were effectively covered, including the direction of migration, the motivation and the demographic characteristics of the migrant. The candidate also showed appreciation of the link with development. The explanations of the role of infrastructure development, greater wealth and more stable government helped lift this answer into band 3. The attempt at a range of examples and a sound conclusion that related back to the question ensured full marks. The answer could have developed some of the points at greater depth and the answer is somewhat short for a 15 mark assessment. The answer is shorter than that for 4(b).

Mark awarded = 13 out of 15

Settlement dynamics

6. a) Explain how bid rent results in different functional zones within urban settlements. [7]

Bid rent refers to the link between price and demand for real estate and how this changes with distance from the CBD. Bid rent theory is responsible for the concentric zone formation found in some cities. Different land users compete with each other for land close to the city centre. This is based on the idea that users (e.g. retailers) wishing to maximise profitability are prepared to pay more for land closer to the CBD which is in short supply. This is linked to access and footfall which is highest close to the CBD. Because of this, retail will often be centred around the CBD to form a functional zone. Different functions such as manufacturing which don't require a high volume are not able/prepared to pay such high bid rents are located in zones away from the CBD where bid rent is cheaper. Residential land use usually occurs in a functional zone on the outskirts where rent is cheaper still. Because of this bid rent declines with distance from the CBD and bid rent lines are steepest for retail, closer to the CBD, and less steep for manufacturing and residential zones.

b) Outline the causes and processes of residential segregation within urban areas. [8]

Residential segregation is the physical separation of two or more groups into different neighbourhoods. One of the main causes of residential segregation is wealth/income. Wealthy people have a wide choice about where to live and choose to live in the best houses and most favourable locations possible. This choice is not possible for poorer people who are limited by low incomes and can only afford to live in certain areas and locations with cheaper housing. Another key cause of residential segregation is race or ethnicity, with people from particular ethnic groups choosing to live together in particular areas. The processes that result in residential segregation include the operation of the housing market, which determines the number and type of houses built and governmental policy which determines, and can drive, housing quotas and the location of new housing. Where housing is in short supply, higher prices and overcrowding occur at the lower end of the market. Residential segregation tends to push people with lower incomes into less desirable housing in poorer locations, often on the periphery. Other processes that occur within cities such as the degeneration or regeneration of areas pull people on lower incomes to the degenerating areas and push them away from regenerated or gentrified areas that become suddenly popular and sought after by those on higher incomes, resulting in residential segregation.

c) With the aid of one or more examples of a Central Business District (CBD), assess the extent to which increasing cost of land is the main cause of change. [15]

The CBD is the commercial core of an urban area which is linked to the high level of accessibility found here. Due to this, CBDs have the highest land and rent values. As the land in a CBD is premium this has a significant impact on the height of the buildings in the area, with high-rise buildings being common. New York's CBD is an example of this with the recently completed One World Trade Centre having a total of 99 floors, gaining the most from the space purchased in a city with notoriously high land values. In terms of building height, the increasing cost of land (alongside the availability of space) is a major factor in CBD change over time. Functional zoning in the CBD often leads to clusters of banks, businesses and shops although due to the need of retail developments to occupy ground floor premises, vertical zoning is also apparent with offices often found stacked on top of retail premises. In this case, the specific needs of the businesses are the main drivers of change but this is also closely linked to increasing land values. A different factor that has driven the change of CBDs, such as in Birmingham, is due to these areas being perceived as dirty, unsafe and as having a poor infrastructure. This has driven large scale change and redevelopment to address these issues and reverse the decline that had been seen. In the case of Birmingham this led to the £530 million renovation which was completed in 2003 and included changes such as the improvement of street lighting and focus on the use of art work to improve the environment. This large scale change was not mainly caused by the increasing cost of the land but by the need to reverse inner city decline. Population flight and the decline of businesses within the CBD can also play a large role in CBD change, as seen in the London Dockland's redevelopment which led to a tri-nuclear CBD by adding Canary Wharf to the West End of the City. This redevelopment came after the decline of the docklands with the movement away from port based trade and attempted to address a number of socio-economic issues left behind. The increasing cost of the land here was not the main cause of change although the potential for significantly increasing the land cost was certainly a factor in the implementation of the LDDC. On balance the increasing cost of land is a strongly influential factor in the cause of CBD change but, certainly in HICs, its significance is matched by other prominent factors.

Examiner comment

Question 6(a)
The candidate has done very well to cover the major explanatory points without using a diagram. The answer demonstrates an understanding of why bid rent is highest in the centre, why land-uses differ in value and how the fact that the highest bidder obtains the most central site produces concentric rings of land-use.

Mark awarded = 7 out of 7

Question 6(b)
The candidate clearly distinguishes between the two aspects of the question. Causes are down to wealth, ethnicity and occupation and these are well supported with examples. Processes mainly focus on the house-price mechanism but political and historical aspects including regeneration are also mentioned. This is a wide-ranging question and the candidate has done well to focus on the key points in the time allowed.

Mark awarded = 8 out of 8

Question 6(c)
This is an interesting answer which explains a range of factors that cause change in CBDs. It is well structured, starting with a review of the impact of increased land prices, the main cause of vertical zoning, but then looks at other factors such as urban decay, transport development and the rise of the internet shopper. There was clear evidence the candidate understood the role these factors play and many others were mentioned, though not as fully developed. Many of these factors overlap and this was hinted at in this answer. It was well supported with examples and offered some assessment in the conclusion. Perhaps more could have been said on the nature of the changes, but this was still a wide-ranging response.

Mark awarded = 15 out of 15

Paper 3 Advanced Physical Geography Options

Answer questions from **two** different options.

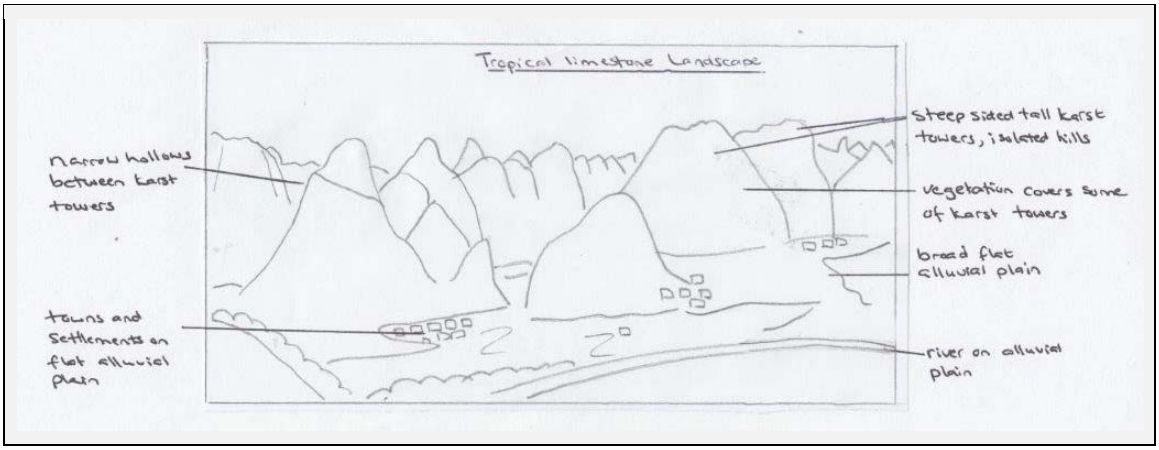
Specimen answers

Tropical environments

If answering this option, answer Question 1 and **either** Question 2 **or** Question 3.

1. Photograph A shows a tropical limestone (tower karst) landscape.

a) With the aid of a labelled diagram, describe the landforms shown in Photograph A. [4]



b) Explain the roles of a rock type and rock structure in the development of the landforms you described in **(a)**. [6]

Tropical karst landscapes are formed where soluble rocks such as limestone are dissolved when water containing carbon dioxide percolates through the jointed structure that is characteristic of limestone. Limestone is particularly susceptible to chemical weathering due to the way carbonic reacts with the carbonate in the rock to form soluble products such as bicarbonate ions. This chemical dissolution of the limestone is further enhanced by the characteristic jointing pattern seen in limestone. Limestone naturally breaks into roughly rectangular blocks due to the vertical and horizontal joints that form within it. The vertical joints are particularly vulnerable to chemical erosion as they forma conduit for water, and therefore carbonic acid. It is the enhanced chemical erosion along these vertical joints that begin the formation of the karts towers as seen in photograph A. The chemical weathering process is also enhanced where limestone lies close to other rocks and where a water table occurs close to the surface. The jointed nature of limestone allows solution holes to form in areas where

jointing is exposed to the surface. The widening and deepening of joints in these areas creates caves which collapse, resulting in limestone towers standing vertically above the flat plains that have been filled with sediment. The solubility of limestone and its jointed nature are key features responsible for the formation of the karst tower landscapes found in the tropical locations of China, Malaysia and Indonesia.

Examiner comment

Questions 1(a)
The candidate has given at least five valid descriptive points and produced an accurate sketch.

Mark awarded = 4 out of 4

Question 1(b)
A good answer that explains both the role of the chemical composition of the rock type and the role of the jointing patterns. This is well related to the process of tower karst landscape formation and some examples are included. The use of diagrams would have greatly helped the explanation but enough knowledge and understanding were demonstrated for full marks.

Mark awarded = 6 out of 6

2. 'Sustainable management in tropical environments is difficult.'
For **either** the rainforest ecosystem **or** the savanna ecosystem, how far do you agree? [20]

Sustainable management in rainforest ecosystems is difficult because of the high economic value of the natural resources found in these areas. The growing international demand for forest products as well as for commercially grown crops such as palm oil, soya and tobacco is threatening this environment. In addition, cattle ranching for export and the vast potential for mineral wealth put considerable pressure on rainforest ecosystems. This high demand, combined with the vulnerability of these ecosystems and the low levels of development of the countries where these ecosystems are located, make the sustainable management of rainforest ecosystems very difficult.

Tropical rainforests are complex ecosystems where the interrelationship between plants and animals and their biotic and abiotic environment is carefully balanced. Biodiversity is high in tropical rainforests due to the high levels of productivity caused by year round rainfall and high temperatures. This is also due to the long periods of evolution without significant climate change. The store and use of nutrients is finely balanced while tropical rainforest soils are heavily leached (due, in part, to the amount of precipitation) and are difficult to manage. The fine balance of these ecosystems is quickly threatened by many types of human activity.

Indigenous people have traditionally survived in small numbers in tropical rainforests, living sustainably without, in most cases, causing permanent or unrecoverable damage to their ecosystems. However, economic pressures on countries and the huge economic potential of the valuable resource on their land has meant that many countries and transnational corporations are ready to exploit the tropical rainforest, without consideration for sustainable management.

Sustainable management is the management of resources (such as the rainforest) without causing a long term impact on the resource. This includes ensuring that the environment can recovery naturally meaning this valuable resource remains available for future generations. There is a great deal of evidence that early and recent exploitation of the rainforests has caused unrecoverable damage on a wide scale. For example, since wide scale mechanised logging in the Amazon started in the 1950s (and the development of an integrated transport infrastructure to support this), rates of deforestation have soared. Over 20 000 rainforest species have become extinct each year, huge pressure has been placed on the drainage basin system and fragile soils have been permanently damaged. Other non-sustainable activities include the seven HEP projects that have been built on the Xingu and Madeira rivers (in the Amazon) to

support mining and associated smelting operations. In addition, the open cast mineral extraction workings at Carajas in north eastern Brazil have decimated the rainforest beyond recovery.

There are however, examples where sustainable management of rainforest environments has been successful. The Heart of Borneo Declaration, established in 2010 was designed to protect the ecological, biological and cultural diversity of the Borneo rainforest by aiming to protect 22 million hectares of rainforest. Changes to the Indonesian and Malaysian timber industry are adopting a more sustainable extraction model, with a focus on sustainable plantations, mainly under the guidance of the Forest Stewardship Council. Clear guidelines and regulations are being put into place for the production of palm oil in Borneo and for mining in the same area. Success has been varied and the focus is often on protecting new areas from exploitation as well as attempts at reforestation.

Small scale sustainable projects have also been successful. The encouragement of a thriving eco-tourist industry in places such as Cost Rica has supported sustainable development. National Forests have been established in the Amazon by WWF, with the National Forest of Altamira being established as a pilot site for sustainable development. The exclusion of Maisin customary lands in Papa New Guinea from timber and large scale agricultural development was supported by Greenpeace and others but legal action had to be taken to establish this. This action will now allow the local community to regulate their own development potential in a "sustainable community owned manner". Despite these small scale successes, sustainable management of the rainforest falls well below expectations both in terms of conserving such a unique and priceless ecosystem as well as supporting indigenous peoples' customs, culture and values.

Sustainable management in tropical rainforest environments is extremely difficult. While the principle of sustainability is supported by most nations and stakeholders, the actual and potential economic value of the rainforest environment places extreme pressures on the countries which contain them as they need to improve living conditions for their people as well as to pay off international debt. The need for these countries to profit from the resource on their land means that sustainable management of these incredible environments is almost impossible.

Examiner comment

Question 2
A clear definition of sustainable management is given, along with an appreciation that it is not simply about conserving the environment. The vulnerability of the rainforest ecosystem is discussed with clear recognition of the fragility which makes it difficult to manage. There could have been more discussion of the nutrient cycle and its disruption by human activity. This could have been discussed following the statement that there is a fine balance within the ecosystem. The pressures of economic development and population growth are examined as threats both to the environment and the ability to manage it. There is then a review of some examples where sustainable management has been attempted with mixed results. An effective conclusion then revisits the question and summarises why sustainable management is hard to achieve. A well-argued and structured answer with good use of examples.

Mark awarded = 18 out of 20

3. For **one** tropical ecosystem, describe the nature of the vegetation and assess how far factors other than climate have influenced the nature of the vegetation. [20]

The tropical rainforest is the most diverse and productive ecosystem in the world. It is also one of the most unique and fragile, with untouched parts of the rainforest said to be in a state of dynamic equilibrium. Temperatures and humidity are so constant in the rainforest, with little seasonal change, that species have specialised to these exact conditions. The vegetation of rainforest environments has adapted to the specific climate conditions, which are the single most important factor in influencing the nature of this vegetation.

The floor of the rainforest is littered with decaying vegetation which decomposes rapidly in the hot humid conditions. Only between 1-10% of the sunlight reaches the forest floor, meaning that plants that do exist here need to be adapted to the dark conditions. The few plants that live here are mostly small herbs with large flat leaves that capture as much of the weak sunlight as possible. Woody plants with stems growing from their base as well as younger plants are found in a shrub layer on the forest floor. There is little undergrowth but moss and ferns are abundant. The dense tree trunks of the canopy and emergent layers are clearly seen on the forest floor. Trees are shallow rooted as they don't have problems getting water and the buttress roots with aerial extensions of lateral surface roots stabilise the trees. Unusual plants such as the carnivorous Pitcher Plant and Venus Fly Trap plants get their nutrients from insects and small mammals sand are found on the forest floor.

The closed canopy layer (25-30 m high), cuts out most of the light from the rest of the vegetation and restricts its growth to a limited understorey of trees, which are denser where the canopy is weaker. This is the most productive part of the forest where photosynthesis is at its greatest. Each tree is carefully adapted to take advantage of the sunlight, being mushroom shaped. Dipterocarp trees are prolific in the rainforest canopies of South East Asia. Lianas and epiphytes such as ferns, lichens, mosses, bromeliads and orchids grow/live on trees canopy trees, but are not parasitic. These sorts of plants also grow up into the emergent layer. Emergent species such as the Kapok Tree and the Brazil Nut Tree can extend to 45-50 metres and extend up beyond the canopy.

The conditions found in the rainforest environments are determined by their global location. The presence of the ICTZ and other planetary circulation characteristics determine the weather found in this region. It is fair to say that the nature of rainforest vegetation is totally influenced by the specific climatic conditions found in

tropical regions. The low diurnal temperature range and annual temperature range means that temperatures are consistently warm. This provides ideal growing conditions for the types of plants that exist in the rainforest environment. The annual rainfall is high, with up to 2000mm per annum. The lack of defined seasons, long daylight hours and the high humidity create unique growing conditions. A climax community is created, referring to the group of species considered to be at a dynamic equilibrium with the prevailing environmental conditions – as is evident in the rainforest.

Climate is also a significant factor in influencing tropical rainforest soils. High rainfall means that the soils in this area are usually heavily leached. The hot humid conditions mean that chemical weathering and the decay of organic matter is speeded up. Soils are well developed, have been weathered for a long time and thus lack nutrients and are inherently infertile. This influences the way in which plants in the rainforest have to be adapted to their environment.

In some areas, human activities have influenced the nature of the rainforest. A plagioclimax community is an area or habitat in which the influence of human behaviour has prevented the ecosystem from developing further. The ecosystem may have been stopped from reaching its full climatic climax or deflected towards a different climax by activities such as slash and burn farming techniques. However where this has been carried out by indigenous people, the area covered is small and the forest is able to recover. Where this human activity has occurred on a commercial scale, linked to logging or the imposition of monocultures, the nature of the rainforest has been changed permanently beyond all recognition.

Although human activity has had a significant impact on the nature of the rainforest vegetation, the impact has been to strip bare and remove large tracts of the rainforest, rather than change the characteristics of the vegetation. However, it is clear that climate is the single most significant factor in influencing the nature of the vegetation in tropical rainforests across the world. The constant temperatures on a diurnal and annual basis as well as the high annual rainfall which leads to high humidity create a very particular climate that rainforest vegetation has adapted to over a long period of time to create a specific niche biome. The soils have been influenced by the climate as well to create the leached and infertile soils that plants have adapted to which reinforces the importance of climate in determining vegetation in the tropical rainforests.

Examiner comment

Question 3
This is a two-part question and candidates need to balance the two. This answer achieves this balance, beginning with a detailed description of the nature of the vegetation with good use of technical terms. It is a little surprising that no diagram was offered as this would have greatly helped here. The link to climate was well established with sound explanation of the causes and effects. A range of other factors was included, but in most cases these could be linked to climate. The chief exception was the role of human activity and how this impacts on the nature of the vegetation. This was well supported with examples and key terms were used correctly. There was an effective conclusion that assessed how far other factors were important compared to climate. The answer was well structured and directly answered the question.

Mark awarded = 20 out of 20

Coastal environments

If answering this option, answer Question 4 and **either** Question 5 **or** Question 6.

4. Fig. 1 shows a stretch of coastline before and after disturbance of a sediment cell.
Fig. 1A shows an undisturbed sediment cell and Fig. 1B shows the sediment cell after disturbance.

a) Describe the changes shown in Fig. 1B. [4]

Fig 1B shows the changes to a sediment cell after disturbance. There appears to be a reduction in input (sediment from cliff erosion and from the river). Input from the offshore bar has been reduced. However the development of a town in Fig 1B has necessitated the construction of a sea wall and a number of groynes to protect the downdrift area. The sand dunes are prone to erosion, the beaches are being depleted and sediment is being removed from the spit.

b) Explain how the changes you have identified in **(a)** have affected the operation of the sediment cell shown in Fig. 1A. [6]

The reduction in input of sediment from cliff erosion and from the river means that the amount of sediment being transported by the process of longshore drift along the coast has been reduced. This may make marine erosion more active and will have an effect on other areas of the coast. Dredging offshore has reduced input from the offshore bar starving the down drift areas of sediment. This has been exacerbated by the construction of the sea wall which further reduces the input of sediment. The construction of groynes has protected the beach in the vicinity of the town but appear to have led to an increase in erosion downdrift. This is evidenced by the sand dunes that are now prone to erosion, the depleted beaches and the erosion of the sand spit. The output of sediment from these areas may be increased.

Examiner comment

Question 4(a)
More than four changes are correctly identified so the candidate exceeded the criteria for the question.

Mark awarded = 4 out of 4

Question 4(b)
This is a well-argued answer that demonstrates a good understanding of the mechanisms in a sediment cell. There is good appreciation of cause and effect with resulting changes to the coastline and the cell.

Mark awarded = 6 out of 6

5. Assess the relative importance of marine erosion and sub-aerial processes in shaping the landforms of rocky coastlines. [20]

Landforms produced on rocky coastlines are caused by the interaction of a number different factors and processes. Lithology and geologic structures are key in determining the appearance of the coastline. The sub-aerial (or cliff-face) processes of weathering and mass movement also have a significant impact. In addition, waves perform a number of complex and interacting processes including marine erosion processes such as abrasion, hydraulic action corrosion, which all play a role in determining the landforms that are created. The typical landforms of rocky coastlines are steep cliffs. The rock is well consolidated and can therefore support its own weight and remain upright. The cliff lines on rocky coasts develop a variety of characteristic features. As most of the marine processes are focused at the base of the cliff, greater erosion occurs here. As a result, wave cut notches form and expand to create caves at the base of the cliff. This erosion is caused by a variety of processes such as abrasion, solution, hydraulic action and cavitation. How these processes are controlled is discussed in later parts of this answer. Once caves have formed the upper part of the cliff is undermined and may become unstable, eventually causing the cliffs to collapse. Where wave action is perpendicular to the coast this results in cliff collapse parallel to the coastline and the formation, over time of a wave cut platform. Where waves are refracted around headlands, the wave cut notches and caves form back to back with one another. When there has been sufficient erosion, these caves may join, creating arches. Further erosion will result in the collapse of the arch collapsing, creating a stack, and eventually when the stack collapses, a stump will form. This too will leave a wave cut platform where the headland is slowly eroded and retreats over time. How these landforms are created and how factors such as lithology, sub-aerial weathering and marine processes influence rocky coastlines are discussed in the next sections of this answer.

Lithology is a key factor in determining the extent to which marine erosion and sub-aerial processes are effective in shaping landforms. The hard rocks such as granite and basalt found on the Devon and Cornwall coast are more resistant and can withstand marine erosional and sub-aerial processes more than less resistant rocks such as limestone and chalk found on the south coast of Britain. As a result, where resistant lithologies are present, steep cliffs develop along with associated landforms such as caves, stacks, arches and wave cut platforms. Marine processes occur equally in the presence of all types of rocks, but work more effectively with rocks that are less resistant; demonstrating why lithology also plays a significant role in shaping coastal landforms.

Geological structure is also a key factor. The angle at which rock strata lie will affect

the extent to which marine erosion is successful. Rates of erosion on concordant coastlines, such as those on the south coast of Ireland occur where rock strata lie parallel to the coastline is controlled by the resistance of the particular type of rock that occurs in the coastal zone. As well as regulating the rates of erosion the lithology also controls the types of landforms that are produced. Discordant coastlines such as those found on the south west of Ireland occur where geological strata are at right angles to the shoreline have unequal rates of erosion. Less resistant lithologies like shale are eroded more quickly than the more resistant rock types like sandstone. This leaves the latter forming headlands, arches and stacks after marine and sub-aerial processes have shaped them over thousands of years. In this case, lithology and geologic structures influence the extent to which marine erosion has an effect on the coastline.

Marine erosion is one of the key processes that play a role in shaping coastlines. Hydraulic action traps air in cracks, joints and bedding planes as waves break onto cliffs. As the wave retreats, this pressure is released explosively in a process known as cavitation. Stress weakens the rock especially where it is well bedded and well jointed for example in limestone, sandstone or where it is poorly consolidated such as clay and glacial deposits. Here, the lithology is probably more important than the type of erosion that occurs. Other processes such as abrasion contribute to the formation of landforms such as wave cut platforms, caves, arches, stacks and stumps. Solution is a form of chemical erosion that also contributes to shaping landforms on rocky coastlines. Solution involves the removal of material by acidic water on rocks such as limestone. Again, the type of rock may be more significant than the process of erosion itself.

The characteristics of waves and the amount of wave energy influence the shape of coastlines. Where destructive waves are frequent, wave energy is high and processes such as abrasion and hydraulic action form cliffs and wave cut platforms. In areas where waves are constructive, erosion is less significant.

Sub-aerial processes include salt weathering, the process whereby sodium and magnesium compounds expand in joints and cracks contributing to weakening rock structures. The process of freeze-thaw weathering, biological weathering and solution weathering all weaken rocks at the coastline, making them more susceptible to marine erosion. Increased weathering leads to increased wave erosion as weathered rock surfaces are more likely to break up, forming the landforms present on rocky coastlines.

Mass movement is another sub-aerial process. It involves the large scale movement of material down an unstable slope and includes rockslides, mudslides, slumps and flows and falls. The causes of mass movement are complex. Often it is the weight of the overlying material, compounded by heavy rainfall that combines with the influences of rock lithology and the angle of bedding planes. These mass movements occur at the coast, sometimes independently of marine erosion or weathering process. However, in some situations, the action of waves at the base of unstable cliffs triggers the mass movement of materials.

It is clear that the shaping of landforms on rocky coastlines is a very complex process. Each landform is specific to the unique local conditions within which it occurs. The rock lithology and geologic structures interact with the processes of marine erosion, sub-aerial processes and other factors such as wave energy. The various combinations of these factors control the effectiveness of these processes. While marine erosion and sub-aerial processes are vital in shaping the coastline, they do not work in isolation and are strongly influenced by the other factors discussed.

Examiner comment

Question 5
This answer balances the need to describe landforms and the ways they are formed with an evaluation of the relative importance of these processes. This answer begins with a discussion of how typical landforms are created on rocky coastlines. The candidate then goes onto discuss several aspects of marine erosion and sub-aerial processes (including mass movement), linking these to the nature of the rock type and structure. Again, this answer would have benefited from diagrams and more detailed examples but it was an effective assessment of the role of the two processes. The conclusion is particularly effective in explaining the complex interaction of a number of factors.

Mark awarded = 19 out of 20

6. With the aid of one or more examples, assess the extent to which soft engineering approaches have more advantages than hard engineering approaches when managing coastline sustainability. [20]

Coastal management approaches aim to protect the coastline from the impact of coastal erosion, cliff collapse and flooding. Successful management approaches require a detailed understanding of the complex marine processes at work as well as the requirements of the local area. In some situations, it is crucial that the management approach protects towns and villages and needs to be effective enough to control natural processes. Similarly, coastal management may need to stop cliff or beach erosion or reduce the impacts of sub-aerial processes. In these cases, hard engineering strategies are usually more effective and longer lasting, although they are also more intrusive and more expensive. In other situations, there may be strong ecological or geological reasons for protecting the coastline – or for leaving it unprotected. In areas where the emphasis is on working with nature to protect less economically valuable areas of the coastline, soft management strategies are employed. These are less permanent, less effective, less intrusive and more sustainable in terms of the environment, but not necessarily in terms of longevity or cost effectiveness.

Hard and soft engineering strategies differ in terms of the degree to which they can be considered sustainable. Sustainability refers to how steps are taken to ensure management strategy or technique does not cause long term permanent or irreparable damage to the environment. Sustainability usually refers to the ability of the environment to recover so that it is in a pristine state for the use of future generations. In this context, suitability refers to the low level impact that soft engineering usually has on ecologically sensitive areas. However engineering strategies can be considered sustainable in terms of economic factors and in terms of effectiveness; both of which are more likely to be found when hard engineering strategies are used to protect the coastline.

Hard engineering strategies usually involve artificial (often concrete) man-made structures designed to interfere with or stop coastal processes such as erosion or coastal flooding. Hard engineering includes features such as sea walls, groynes, rock armour, revetments, gabions and off-shore break waters. These structures are all expensive, costing between $4300 and $8600 per metre. Sea walls are very effective but are intrusive and unnatural to look at. They are also made of concrete, which is not a sustainable resource. Sea walls are expensive and also have high maintenance costs. They certainly couldn't be considered to be sustainable. Groynes are another popular hard engineering management strategy. These are timber or rock structures built at right angles to the sea which trap the sediment that is being moved along the beach by

longshore drift. Although groynes work with natural processes to build up the beach they cannot be considered sustainable. As well as looking unnatural, groynes starve beaches downdrift, and move the problem, rather than solve it.

A number of hard engineering strategies are often employed together to effectively protect the coastline. At Walton-on-the-Naze in Essex, a large sea wall was built at the base of the cliffs to protect the Naze Tower, an important historic monument in the north and to protect the adjacent town. In addition, wooden groynes were constructed to interrupt the northerly drift of sediment and to build up the beach. Hard engineering strategies such as these could only be considered sustainable in economic terms; they are expensive to construct, vary in terms of maintenance costs, but don't need to be replaced for long periods of time, making them arguably more cost effective.

Soft engineering strategies involve a more environmentally friendly approach to coastal management. Natural materials are often used and there is an attempt to work more sustainably with the natural processes. Soft engineering strategies are often used in ecologically sensitive areas where the economic value of the land tends to be lower, but the visual impact of the technique needs to be minimal, or where the natural habitat needs to be preserved. Soft engineering strategies include beach nourishment, dune stabilisation and managed retreat. Beach nourishment involves adding local sand and shingle to existing beaches to make them higher and wider. This is relatively cheap and also looks natural, blending in with the existing beach. Dune regeneration is usually done by planting Marram Grass to stabilise the dunes and help them become re-established. This maintains the natural environment, provides important wildlife habitats and is cheap and sustainable. A good example of managed retreat can be seen at Abbots Hall Farm in Essex. An old damaged sea wall was removed allowing the low value agricultural land to flood. Counter walls were built to protect the neighbouring farmland. The Essex Wildlife Trust established a new salt marsh which created important bird habitats for migrating species. The marshes were also used for important fish nurseries for Bass and Herring. This is clearly a sustainable use of the coastline directly created by an effective soft engineering management strategy.

It is clear that soft engineering approaches have significantly more advantages when it comes to managing a coastline sustainably. Natural materials are used that fit in with the surrounding area, techniques are expensive, less intrusive and have a more favourable visual impact. In addition, one of the key foci of soft engineering strategies is to protect valuable ecologically sensitive areas and the focus of this is sustainability.

Examiner comment

Question 6
This answer starts well by displaying a clear understanding of sustainability and the problems of balancing costs with the resulting benefits. A number of hard and soft engineering approaches are discussed with supporting examples. This answer gets into the top band by covering most of the aspects required by the mark scheme without going into great depth on any one aspect or example. It is the structuring of the assessment, linked throughout to the issue of sustainability that makes this a good answer. The conclusion comes down on one side of the argument.

Mark awarded = 19 out of 20

Hazardous environments

If answering this option, answer Question 7 and **either** Question 8 **or** Question 9.

7. Fig. 2 shows the vertical drop and horizontal travel distance of two volcanic hazards.

a) Compare the relationship between vertical drop and horizontal travel distance of the volcanic hazards shown in Fig. 2. [4]

Pyroclastic flows travel further horizontally than volcanic landslides, regardless of how high the vertical drop is. Pyroclastic flows travel horizontally between 2km to 70 km, and have a much greater range than volcanic landslides. There appears to be no close correlation between the distance travelled and the vertical drop. For example where the vertical drop is 1km, some pyroclastic flows travel 2km, while others travelled 10km, 15km or 70km. Volcanic landslides travel between 10km and 30km horizontally. There is a clear positive correlation between the vertical drop and horizontal distance travelled for volcanic landslides, i.e. the greater the vertical drop, the further the volcanic landslide travels.

b) Outline how the information shown in Fig. 2 can be used to predict the potential impacts of the **two** hazards on lives and property. [6]

Both pyroclastic flows and volcanic landslides can travel significant distances from their point of origin. Planning and preparation for volcanic events needs to take account for this. Pyroclastic flows are very hot (up to 700˚C) and can travel very fast. They can also travel long distances – up to 70km as shown in Fig 2. This means that where it is evident that a volcano is likely to erupt and there is concern that pyroclastic flows could occur, the zone of evacuation needs to be extended so that people within an approximate radius of about 100km should be moved. The unpredictability, speed of travel and distance covered make pyroclastic flows a serious hazard. Where volcanic landslides are predicted, the evacuation zone needs to be established in accordance with the vertical drop. The higher the volcano, the further the horizontal distance travelled is likely to be. In addition, local topography may affect the direction and speed of both pyroclastic flows and volcanic landslides; valleys may funnel pyroclastic flows and steeper areas on the volcano may cause more devastating and wider reaching volcanic landslides.

Examiner comment

Question 7(a)
The relationships are well identified and accurately compared. Good use is made of the data.

Mark awarded = 4 out of 4

Question 7(b)
There is a clear focus on the prediction of impact for both hazards, with some use of a case study example to illustrate the points. The candidate has answered the question concisely and effectively.

Mark awarded = 6 out of 6

8. 'Hazard mapping is the most effective way of reducing the impact of earthquakes on lives and property.'

How far do you agree with this view? [20]

Hazard mapping is the consideration of areas that are affected by, or are vulnerable to, a particular hazard. It is based on the consideration of the concepts of vulnerability and risk. Hazard maps are created for natural hazards such as earthquakes and help to determine the risk of living in a certain area. Hazard mapping can help individuals to become aware of the danger they might face from earthquakes in a specific area but they are primarily used by professionals to predict and plan for earthquake events.

The USGS produces National Hazard Maps to show the distribution and probability of earthquake shaking levels in the United States. These maps were created to provide the most accurate and detailed information possible to assist engineers in designing buildings and other infrastructure that will withstand shaking from earthquakes in the United States. These maps are used to create and update the building codes that are now used by over 20,000 cities, counties and local governments to help establish the construction requirements necessary for public safety in the event of an earthquake. The clear intention of hazard mapping is to reduce the impact of earthquakes on property and life and they clearly play a significant role in achieving this.

Hazard maps provide a focus for the monitoring of faults in specific areas. They are used to collate information about small scale ground surface changes, uplift or subsidence. They plot micro-earthquake activity. The frequency and location of past earthquakes can be used to calculate the possibility of future occurrences. Hazard mapping plays a key role in achieving this.

The seismic gap theory states that over a prolonged period of time all parts of a plate boundary must move by almost the same amount. If one part of the plate boundary has not moved and others have, then the part that has not moved is most likely to move next. This theory was instrumental in predicting the 1989 Loma Prieta earthquake and subsequent earthquakes along the Central Kuril segment of the Kuril-Kamchatka trench after the 2004 South Asian tsunami. The precise plotting of monitoring data contributed to this success.

Other methods are used to monitor ground movement and to predict the possibility of earthquakes. Satellite surveying equipment monitors plate movement and minute changes in the surface of the earth with an accuracy of a few centimetres. Data is relayed to earth and then processed by computers. Monitoring changes in radon gas

concentrations, the electrical resistivity of rocks, groundwater levels in wells and strain in the crust all help to identify changes that may indicate an earthquake is likely. Scientists are even investigating and monitoring the behaviour of insects and animals which has helped to predict earthquakes. This type of monitoring supplements the data provided through hazard mapping.

Even with the support of hazard mapping, earthquake prediction is far from a precise or accurate science. In the past, monitoring of crustal stresses along the San Andreas fault in California led to predictions of an earthquake near Parkfield between 1988 and 1992, although the earthquake actually happened in 2004. In Haicheng, China in 1975, observations of changes in land elevation, ground water levels and peculiar animal behaviour led to an evacuation warning the day before a 7.3 earthquake occurred, saving thousands of lives. However there was no warning before the 1976 Tangshan earthquake (China), which caused 250 000 fatalities. There was also no warning before the 2008 earthquake which killed 70 000 people in Sichuan (China). This illustrates that even with careful monitoring, prediction of the timing, precise location or earthquake strength is unreliable.

It is not necessarily just the prediction of an actual event that reduces the impact of earthquakes, but the steps that are taken to ensure that building design and construction are safe. New buildings can be constructed to be 'life safe' so that they can withstand ground shaking. Techniques to achieve increased building safety include constructing single storey buildings, creating a 'soft storey' e.g. a car park beneath buildings, reinforcement such as steel frames and creative technologies such as counter weights and 'spring' foundations. Retrofitting of older buildings involves applying cross bracing to prevent the building from twisting to reduce damage and associated loss of life. In less developed countries, appropriate technology such as small windows, mesh reinforcement and shock absorbers made of tyres can reduce damage and loss of life. While hazard mapping can recommend that these preparations take place, their success is due to legislation for safer buildings and diligent monitoring and enforcement of this guidance. It can be argued that hazard mapping suggests the possibility or degree of risk, but preparing for and carrying out recommendations is beyond its remit.

Other measures that reduce the impact of earthquakes involve awareness and the education of people, ensuring that they know how to keep themselves and their homes safe during an earthquake event. This includes preparing them so that they know what to do during an earthquake, which could potentially save lives. Stocking emergency supplies, carrying out earthquake drills and preparing for tsunamis also helps

populations prepare. The implementation of these actions is the responsibility of local, national and regional agencies based on, but not solely due to the process of hazard mapping.

Hazard mapping clearly provides information and a focus for the prediction and management of earthquakes and plays a significant role in reducing the impact of earthquakes on lives and property. However hazard mapping cannot be seen as the single most effective method – it does not occur in isolation and should be seen as a significant part of an overall strategy to monitor, predict, plan and prepare for earthquake events.

Examiner comment

Question 8
This is a well-rounded answer which explains hazard mapping and then assesses its effectiveness, supporting the points made with case studies. Having established the strengths and limitations of hazard mapping, alternative approaches are considered, for example, monitoring to give early warning of an earthquake, reinforcing buildings, as well as preparation for and raising awareness of such events. The strength of this answer lies in its structure and logical progression. There is clear assessment and an effective conclusion which points out that hazard mapping should be part of an integrated approach. The use of examples is sound if a little patchy. The depth of knowledge and understanding shown in this answer places it in the top band.

Mark awarded = 20 out of 20

9. Assess the extent to which the hazardous effects of tornadoes are different from those of tropical cyclones. [20]

Tropical cyclones and tornadoes are both hazards that result from atmospheric disturbances in the tropics. Both are capable of causing considerable damage to property and loss of life. However, in terms of their formation, movement, scale, area of travel, life span and predictability, they are very different. Tropical cyclones are considered large scale tropical disturbances, while tornadoes are considered to be small scale. Tropical cyclones cover much larger areas, their effects are more wide spread and experienced for longer periods of time. Tornadoes are more intense, smaller scale events which cause devastation and destruction mainly due to the extreme wind speeds associated with them.

Tropical cyclones are the most violent, damaging and frequently occurring storms and are found in many tropical regions across the world. Unlike tornadoes they form over warm oceans where temperatures are high enough to provide the required latent heat which is stored during evaporation and released during condensation. Tropical cyclones are very large, between 500-800km in diameter, and have a life cycle of days, rather than the hours of a tornado. The damage caused by tropical cyclones can cover hundreds of kilometres and tropical cyclones can develop and last for weeks before they dissipate. The scale of tornadoes is much smaller and their lifespan is much shorter. The effects of a tornado are minute compared to the effects of a tropical cyclone.

The hazards associated with tropical cyclones are felt when they reach land. Storm surges cause waves up to 3m which inundate the coast. This water sweeps inland causing widespread flooding. Strong winds in excess of 120km per hour are capable of tearing roofs off buildings, breaking windows and damaging communication and transport networks. Torrential rain and flooding are caused with rainfall exceeding 200mm in just a short period of time.

In November 2013, Typhoon Haiyan, a category 5 tropical cyclone on the Saffir-Simpson scale hit the Philippines. Huge areas of coastline and several towns were devastated by winds of up to 275km per hour. Waves as high as 14m were produced in one of the most severe tropical cyclones ever experienced. 6300 people lost their lives, mainly due to drowning in the storm surge. In total, 600 000 people were displaced and 40 000 homes damaged or flattened. In the long term, 14 million people were affected and 6 million people lost their source of income. The scale of damage caused by this 'super' tropical cyclone was intense and the effects wide spread. Although this was the most intense tropical cyclone every recorded, its effects are not

uncommon. The scale, amount of damage, loss of life and the intensity of the effects caused by a tropical cyclone are significantly different to those experienced as a result of tornadoes.

Tornadoes are small and short lived but highly destructive atmospheric disturbances. They consist of elongate funnels of cloud that descend from well-developed cumulonimbus clouds, eventually making contact with the ground below. Within tornadoes, whirling rotating violent winds reaching up to 100m per second have been recorded. Pressure gradients are extreme – reaching an estimated 25mb per 100m, compared to 20mb per 100 km that are experienced in tropical cyclones. Once contact has been made between the ground and the cloud, tornado tracks can extend for a few kilometres or even hundreds of kilometres. The width of the tornado vortex is rarely more than 200m. About one thousand tornadoes occur every year in the USA, on average killing 60 people per year. Most damage is caused by flying or falling debris although tornadoes are also associated with heavy rainfall, hail and thunderstorms.

Tornadoes are experienced in Europe, Southern Africa, Eastern Asia and in parts of Australia. However they occur most frequently in central USA in an area known as Tornado Alley. From 1950 to 2001, 1024 tornadoes caused more than $1.7 billion in damage in Indiana (USA) and killing 223 people. While the monetary value of the damage is high, the death and destruction of property is much less than that caused when a tropical cyclones reaches land.

Although both tropical cyclones and tornadoes are associated with strong winds and both can cause destruction and loss of live, the hazardous effects of tornadoes are completely different to those caused by tropical cyclones. The hazardous effects of tornadoes are limited in their extent and the damage caused is associated with rotating winds and intense low pressure. The hazardous effects of tropical cyclones occur over a much wider area and are not restricted to damage just caused by strong winds. Most deaths associated with tropical cyclones are caused by drowning as a result of storm surges. Damage to structures can be caused by strong winds, but a lot more damage is as a result of the flooding due to the storm surges and heavy precipitation. Tropical cyclones tend to cause greater loss of life (especially in less developed countries whose location puts them in the path of tropical cyclones) than tornadoes. The damage to buildings and infrastructure and the loss of farmland and earnings is significantly higher for tropical cyclones than tornadoes. It is clear that the hazardous effects of tornadoes are very different to those of tropical cyclones.

Examiner comment

Question 9
A wide-ranging answer that initially explains and then contrasts the scale, origin and location of the two hazards. Their respective impacts are then compared, including both their primary and secondary effects, for which detailed examples are given. This is a well-structured answer that assesses the difference in the effects of the hazards and offers some explanation of the contrasting scale of their effects. An effective answer which demonstrates good knowledge and understanding of the two atmospheric hazards. The only slight issue is that the hazard caused by pressure differences inside/outside of buildings as the tornado passes is not mentioned. Explosion outwards of buildings is one of the main hazards. However, overall it is a very substantial answer.

Mark awarded = 20 out of 20

Hot arid and semi-arid environments

If answering this option, answer Question 10 and **either** Question 11 **or** Question 12.

10. Fig. 3 shows areas at high risk from desertification.

a) Describe the distribution of areas with high risk of desertification shown in Fig. 3. [4]

The areas with high risk of desertification tend to be located around or alongside existing deserts. They are found on every continent. Key areas at risk include the land north and south of the Sahara as well as the land in the south east of Africa between the Namib desert and towards the Kalahari. Large areas of the Middle East, extending into Iran and Pakistan in south west Asia are also at risk. In Australia the Great Victoria desert is expanding and now at risk, as are areas to the south of this and additionally two locations in the east of Australia around Simpson. The west coast of USA, around Sonora and the Great Basin are at risk of desertification, as is a strip of land east of the Atacama, extending down to Patagonia in South America.

b) Outline possible reasons for the distribution of areas with a high risk of desertification that you have described in **(a)**. [6]

The areas with a high risk of desertification are all located adjacent to or surrounding existing deserts. This suggests that the desert areas are expanding outwards. One of the most obvious causes of desertification is human action where over grazing, over cultivation or the over extraction of water leads to soil degradation and soil erosion increases the risk of desertification. In some areas, deforestation has occurred as local people have removed trees for firewood. The loss of vegetation removes the protection (previously given by the binding effect of roots) from the soil, allowing the soil to be easily removed by wind and water so creating the conditions for desertification. In some cases, desertification occurs because of natural causes. Extended periods of drought caused by changes to global circulation or even local conditions caused by cold ocean currents or the rain shadow effect linked to orographic rainfall. The lack of precipitation causes vegetation to die back, accelerating soil erosion by wind and water.

Examiner comment

Question 10(a)
A large number of valid points are given, gaining full marks. The overall pattern could have been further developed, especially in the context of latitude.

Mark awarded = 4 out of 4

Question 10(b)
This answer recognises the twin forces of human activity and natural climatic conditions in creating desertification. There is recognition that areas most at risk are marginal areas, which are easily affected by small changes in climate or human activity. Some appropriate examples were included. There is clear evidence of the causes and effects of desertification, although the feedback mechanisms could have been developed to show how, once started, desertification tends to be reinforced. There is enough knowledge and understanding, both of the process and its causes, to gain full marks.

Mark awarded = 6 out of 6

11. Evaluate the importance of the role of Pleistocene pluvials in the development of desert landforms. [20]

During the Pleistocene Ice Age 30% of the world's surface at higher latitudes contained ice. At lower latitudes increased rainfall was experienced during pluvial periods. A pluvial is either a modern climate characterised by relatively high precipitation or a period of time of variable length, decades to thousands of years, during which a climate is characterised by relatively high precipitation or humidity. A pluvial lake is a landlocked basin which fills with rainwater during times of glaciation. As climatic conditions changed the water that formed rivers in pluvial periods and the water from pluvial lakes evaporated, drying out these landforms completely. The presence of this water allowed for landforms linked to the presence of water to develop in areas that are now desert. The existence of certain landforms in deserts today are clear evidence of past climate change as the wetter conditions under which they formed are no longer present.

There is considerable evidence for the presence of pluvial periods in desert areas such as the Sahara and Mojave Deserts. This includes dry salty basins that are evidence that water levels were higher in the past. Along with the physical geographic evidence, living organisms have left traces of their existence in ancient lakes. This includes pollen, siliceous protozoans, biogenic silica, diatoms and algal pigments. The presence of such landforms and biologic evidence show that pluvials were present in geololgic past of current desert regions.

On the edge of the Sahara, Lake Chad is an example of a pluvial lake that existed in wetter conditions than currently exist. Lake Chad may have been 120m deeper than it currently is and may have extended hundreds of kilometres north of its current position. More specific evidence occurs in areas where spring deposits of lime (tufa) were formed by the precipitation of carbonate minerals from ambient temperature water bodies. Again, this could only have occurred if wetter conditions existed at their time of formation. Fossil soils have been found that represent the more humid conditions that occurred in the past. In addition, there is evidence that river systems existed which are now blocked by sand dunes. Additional evidence of pluvial periods is the presence of past plant and animal life (that is characteristic of savanna grasslands) in areas that are now too arid to support this type of life, as well as evidence of cave paintings which shows that these areas were habitable enough for humans to exist in.

Salt lakes are found in the lowest part of the desert where ephemeral streams flow in to inland depressions for example the Chott el Djerid of Tunisia. After flowing into depressions, water evaporates leaving behind a thick crust of sodium chloride, gypsum, sodium sulphate etc. evidence of salt flats and salt lakes are abundant in desert areas today and could only be formed in the presence of water.

Some landforms and features, for example extensive dry valley systems exist in deserts today that could not be formed in the dry conditions that currently exist. They could only be formed if there was an abundance of water. Wadis are river channels that vary in size from a few metres to over 100km. These are steep sided and flat bottomed. They may have been formed by flash floods but it is more likely that they developed in wetter pluvial periods during the Pleistocene. Mesas, plateau like features and similar but smaller buttes may also have developed as a consequence of high energy rivers cutting down into the landscape during wetter pluvial periods. In periods of continuous high flow, rivers would have washed softer sediment from the hill tops until strong durable rock was exposed. This harder rock is less susceptible to the action of the river and so forms the hard cap rock of the mesa we see in the landscape today. Such widespread removal of overlying sediment from the landscape by river activity would have only been possible in wetter climate conditions, such as those of a pluvial period. A Piedmont zone is a flat gently sloping heavily sedimented area. These zones characteristically have alluvial fans which form when large quantities of sediment are deposited after a flood event. These depositional landforms only occur when there has been significant run off due to high levels of rainfall. Features like wadis, mesas and piedmont zones are evident in many desert areas today and make up many of the characteristic desert landforms. They are strong evidence that Pleistocene pluvials must have played a key role in the formation of desert landscapes.

In contrast, landforms that exist in deserts today are created specifically in dry conditions. Erosion by means of processes such as wind abrasion are responsible in part, for landforms such as mushroom rocks/rock pedestals, zeugens and yardangs. Transportation of sand and sediment and their subsequent deposition causes the development of a variety of sand dunes e.g. parabolic, barchan, linear and star dunes. These could only be formed in very dry conditions that exist today where a large volume of sand, dust and associated materials is present. These landforms are evidence that the pluvial periods are not responsible for all of the features seen in desert areas today.

It is clear that in some deserts the Pleistocene pluvials have played a key role in creating vast landscapes that could only have been formed in the presence of greater amounts of water than occurs today. Vast tracts of desert such as the Badlands in USA only exist because of this. However pluvials are not responsible for all of the landforms in desert areas as many of them have been formed in the dry desert conditions that currently exist.

Examiner comment

Question 11
This is an effective answer that demonstrates a clear logical argument. Initially, it sets out why and when pluvial periods occurred and then reviews the range of evidence for this. The focus then moves to the range of desert landforms that can only be explained by a wetter pluvial period. These would have benefited from diagrams and/or more detailed examples. The aspect that lifts this answer into the top band is the discussion of desert landforms that result from other desert processes, namely wind. Again, these would have benefited from some labelled diagrams. The answer has a sound conclusion.

Mark awarded = 19 out of 20

12. 'Humans can effectively manage arid environments.'
How far do you agree? [20]

Arid environments are landscapes that have a permanent water deficit, experiencing less than 250mm of rainfall per annum. These areas are not necessarily barren or desolate landscapes, but are environments that have offered a way of maintaining a living to indigenous people for generations. As mismanagement of arid environments leads to increased desertification and as population growth puts more pressure on the land, it becomes even more essential for arid environments to be managed sustainably. Such management would ensure that there will be viable habitats for a wide range of birds and animals and that the basic needs for water, food and shelter for local indigenous people can be met.

There is a great deal of evidence that we haven't effectively managed arid environments in the past. 25% of the global land territory and almost 16% of the world's population is currently threatened by desertification. It is estimated that nearly 12 million hectares of land is lost every year due to drought and desertification, while 74% of the poorest people are directly affected by land degradation globally. The negative effects of degraded soil may be most severe in countries that are highly dependent on agriculture for their income.

In order to effectively manage arid areas, techniques should be sustainable. This means that they meet the needs of the present without damaging the resource for future generations. Land conservation and rehabilitation are essential parts of sustainable agricultural development in arid areas. Examples of sustainable management of these areas include encouraging nomadic pastoralism and paddocking, ecotourism, crop rotation to prevent soil degradation and sustainable irrigation from the desalination of sea water or deep wells to tap fossil water.

In the Sahel, initiatives to try to reduce desertification and famine, and to manage the environment sustainably have been supported by international charities such as OXFAM. On the central plateau of Burkina Faso, innovative techniques in soil and water conservation and agro-forestry have been established. For example stone lines built by farmers across the land contours are a cheap and popular erosion control method. They slow the overland flow of summer rains and capture water where it is needed by the growing crops. In addition, this also encourages the deposition of sediment rich in soil nutrients. Such schemes have transformed the rural landscape around hundreds of villages in this part of Burkina Faso, providing food for local people and managing

landscape sustainably through the use of appropriate technology.

Another example of an initiative to manage arid environments is in the Eastern Cape of South Africa. Drought resistant fodder crops such as the American Aloe, Prickly Pear and Saltbrush have been planted. The American Aloe requires little water and is not attacked by insects. These plants help to conserve the soil and can be used as windbreaks and over time produce a pole that can be used for fencing or building. Saltbrush provides protein rich fodder for sheep and goats. Once established Saltbrush needs no irrigation and can provide all year round fodder. This means that animals are not over grazing areas and so further land degradation is prevented. Prickly Pear has very low water requirements and can be used as fodder or harvested and sold as a fruit, bringing in a small income for indigenous people. This initiative has successfully encouraged the sustainable management of this arid region by enhancing the environment and reducing further damage.

The Mojave Desert in the USA is another example of where sustainable management is protecting an arid area from desertification and further soil degradation. The Mojave Desert is carefully managed by public organisations including the Bureau of Land Management, the National Park Service and the Department of Defence. As an HIC, there is access to higher levels of funding and so the sustainable management occurs on a larger scale and the techniques employed are more sophisticated. The Californian Aqueduct transfers water from the Sierra Nevada Mountains to the Mojave via a series of canals, tunnels and pipelines. The water is used to produce alfalfa which is a cash crop. While this is not necessarily a sustainable project, it does allow the desert to be exploited without further damaging this resource. In addition, between 1996 and 2006 $93 million was spent on various projects to save the Mojave Desert tortoise from extinction. Again, while not being particularly cost effective, the re-establishment of an endangered species supports the principle of sustainability.

These examples make it clear that humans can effectively manage arid environments where local people have the support of government or voluntary agencies. Where there is will and appropriate funding, small scale projects using appropriate technology can support local people to manage the land sustainably. In more developed countries, funding is more generous and the sustainable management of arid areas can become a national priority. Unfortunately the amount of effective management occurring is small and there are vast tracts of land are not being sustainably managed. This is leading to encroaching deserts, soil degradation and the desertification of previously non-desert areas.

Examiner comment

Question 12
This is a well-structured answer which develops a strong discursive evaluation of the key points. An initial context is given and a variety of ways to manage these fragile environments is considered. The management techniques considered range in scope from small local projects to national-level schemes. The points made are supported with appropriate and wide-ranging examples. The question is really asking whether it is better to manage an arid environment by adapting to it or by adapting the environment and/or its constituent elements to meet human needs. The conclusion demonstrates a high level of understanding in relation to this. There is clear evaluation and this places the answer in the top band. However, the discussion of the Eastern Cape is not really relevant as it is a semi-arid area (precipitation is generally over 250mm). Candidates often use the Eastern Cape as an example of a semi-arid area. Its use here demonstrates a slight misunderstanding.

Mark awarded = 17 out of 20

Paper 4 Advanced Human Geography Options

Answer questions from **two** different options.

Specimen answers

Production, location and change

If answering this option, answer Question 1 and **either** Question 2 **or** Question 3.

1. Fig. 1 shows models of two agricultural systems.

a) Compare the systems shown in Figs. 1A and 1B. [4]

Figure 1a shows extensive farming where a relatively small amount of food is produced per hectare. By comparison to figure 1b it is clear extensive farming uses more land than the intensive farming and produces less product. Extensive farming has smaller inputs (other than land) than intensive farming where capital, energy and labour inputs are significantly higher. Extensive farming has only a small quantity of by-products in addition to the food outputs whereas intensive farming has two, significantly larger, outputs as well as the food produced.

b) Explain the advantages and disadvantages of extensive subsistence farming. [6]

Extensive subsistence farming can be both arable and pastoral and, in both forms, this type of farming is particularly efficient when balancing labour and cost inputs against agricultural produce outputs. Shifting cultivation is a form of arable extensive farming which is very low cost and which has little environmental impact in comparison to more intensive farming practices. This is because of the low quantities of waste and the opportunity that natural environments are given to recover when the farmers who work the land move on. This type of farming meets the food demands of the communities who practice it, whilst maintaining their traditional way of life. Nomadic pastoralism is a form of pastoral extensive farming which is practiced by Maasai cattle herders in Kenya. This form of farming can be seen to have many of the benefits of shifting cultivation but it can also be seen as an inefficient form of farming which produces a low food yield in comparison to the huge areas of land that the farmers and their cattle have to range across. The introduction of new safari park boundaries has had a significant negative impact on this way of life for the Maasai people, as well as illness in the cattle population, highlighting the fragile nature of some forms of extensive subsistence farming.

Examiner comment

Question 1(a)
A good range of comparative points, more than enough to gain full marks.

Mark awarded = 4 out of 4

Question 1(b)
The candidate has considered a range of advantages and disadvantages of extensive subsistence farming although it is slightly unbalanced. Both arable and pastoral systems are discussed and supported with examples. Clear knowledge and understanding of the farming system is demonstrated.

Mark awarded = 5 out of 6

2. With reference to one or more examples, evaluate the role of the government in promoting agricultural change. [20]

Agriculture still plays a vital role in the economy of many communities and countries and it is therefore possible to observe agricultural change on a number of scales. Though the role of government management of this change is not the only factor, it is the most important on a large scale. This can be seen in Jamaica, a country whose agricultural production is dominated by traditional crops such as sugar, bananas, coffee and cocoa. Other products include non-traditional crops such as sweet potatoes, and beef and poultry livestock.

The government in Jamaica have had to implement policies to reverse the spiral of decline that has been apparent during the last 20 years in agriculture. The country's heavy dependence on this sector is shown by the fact that it accounts for 7% of Jamaica's GDP and employs 20% of the total workforce. The abandonment of marginal land, the removal of preferential treatment for bananas on the European market, the spread of disease and climatic hazards have all threatened the agriculture sector, in turn threatening Jamaica's employment, income and food security. To reverse this, the government has introduced the New Agricultural Development Plan, which aims to transform the agriculture sector by 2020. By aiming to increase production across eight key areas (such as the fruit tree crop development project), Jamaica's government are promoting large scale change which should allow agricultural sustainability, effectively safe-guarding this important sector for the future. This country-wide programme shows that the role of government is crucial in progressive change.

Another example of the importance of the role of government in agricultural change is apparent when looking at the change in the composition of crops produced in Jamaica. Due to political factors there was a 36% cut in the price paid for raw sugar exports by the EC. The Jamaican government have had to change their policy to set new targets for production in the production of raw sugar; molasses and ethanol. The significant damage to the agricultural sector in Jamaica due to the erosion of preferential treatment has been stemmed by the government's actions. It could be argued that more could have been done to protect farmers due to the advanced warning that the government had about this change. The major issue here is the limited impact that a country like Jamaica can have on international trade.

The modernisation of the agriculture sector in Jamaica has been driven by the government but they have collaborated with stakeholders within agriculture. Both ABIS

and GIS are being used in the country to collect and disseminate vital information with the aim of boosting productivity and trade. The implementation of these ICT techniques is costly which is why investment from both the public and private sectors are so important. It could be argued that greater investment by the government would have encouraged faster progress but investment is limited due to Jamaica's LIC status. In the case of ICT modernisation, the government's role can only be as effective as monetary input allows and this is impacted on by factors outside of their control. The mapping of land to inform management also cannot overcome issues caused by climatic hazards such as tropical cyclones and drought.

Overall, it is clear that the role of government is essential in promoting agricultural change. Sadly, as the countries who still heavily rely on agriculture are almost exclusively LICs, they often have a number of factors to overcome if this change is to be successful. In Jamaica, the government have used a variety of approaches in the attempt to combat the difficult social, economic, environmental and political issues they are faced with. This programme has seen some success, although the best measure of these policies will come from the analysis of Jamaica's agricultural sector in future years.

Examiner comment

Question 2
This is a big topic and this answer does well to cover a wide range of the possible content. The detailed case study of the role of the government in Jamaica covers a number of strategies and their impact on farming. The answer clearly appreciates that other factors could play a key role in promoting change and that the motivation for these might be very different from that of a government. The use of examples was sound but could have been more detailed in places. There is enough knowledge, understanding and assessment to warrant the top band. The conclusion could have included more precise evaluation of the role of the government compared with other influences.

Mark awarded = 18 out of 20

3. How far do you agree that the informal sector of manufacturing and services has an important part to play in the economy of LICs/MICs? [20]

The informal sector of employment relates to jobs which are not known to the government and are therefore not formally taxed or monitored. These are often poorly paid, temporary roles which have few or no extra benefits associated with them. Due to the nature of these roles, it is very difficult to collect accurate data about the volume of people operating in this area of the economy. If estimates of the volume of people that are predicted to work in the informal sector of manufacturing and services (up to 95% of the workforce in LIC and MICs) are even partially true, it suggests that they will have a very important role to play in the economy of these countries. It is important to note that the role which the informal sector plays in the economy varies by country and also significantly between urban and rural areas within countries.

China is an MIC with a population of over 1.3 billion and around 750 million of these people live in urban areas. Estimates suggest that up to half of all employment in urban China is in the informal economy, with much of this total made up of migrant workers who are not registered to work in cities and so lack formal protections. This means that the informal sector has a very important role in China's economy, contributing to employment of the population and, through the multiplier effect, to the country's economic growth. China's rise as the global centre of manufacturing could owe part of this success to its willingness to trade in the informal economy, and producing unregulated goods for consumption in Africa, Asia and Latin America. This fast-growing, dynamic and competitive part of the Chinese economy is obviously not without issue. There have been reports of local governments promoting unregulated, informal sector employment to combat unemployment and boost economic growth. Such action has been met with calls to address the lack of protection offered to these workers. It is however an important part of the Chinese economy at present and it appears to have the potential to further increase China's level of economic development.

India is another one of the four BRIC economies currently undergoing rapid economic growth. The difference between India and China is that the economic growth in India is mainly centred on the service sector, rather than manufacturing as is the case in China. Mumbai, the wealthiest city in India, is home to a large sprawling slum development called Dharavi with some 1 million residents. This slum settlement is estimated to generate $40 million worth of business annually in over 4,500 cottage industries and other types of informal employment. This clearly shows the large scale economic impact the informal sector can have. The number of people whose lives are supported by the informal sector in Dharavi is astounding, even more so when it can be seen that a number of the potteries, bakeries, recycling outfits and manufacturing

plants have been established and are run by entrepreneurs from Dharavi itself. Self-made millionaires do appear to exist within the slum. The residents in Dharavi are using the income from these employment opportunities to improve their quality of life, and in many regards this is working. Crime rates are low, the community spirit is seen as a model to be repeated in other parts of the world, and many residents have access to education. There are still significant issues with sanitation, over-crowding and access to healthcare but the successes of this slum have the potential to be harnessed by the government to further improve the lives of residents, and potentially move some of these informal jobs to a more-regulated, formal sector.

Overall, I would suggest that these two examples show that the informal sector of manufacturing and services has a very important role to play in the economies of LICs and MICs in supporting their journey along the development continuum. As with most aspects of development, there are a number of controversial issues surrounding the informal sector, particularly in regards to employee rights but also in terms of other regulation such as environmental monitoring. The level of impact varies between countries and may be lower in LIC economies but, when a country as large as China reportedly has have half of its urban workforce employed in the informal sector, this can have a significant economic impact.

Examiner comment

Question 3
A sound review of how important the informal sector is in LICs and MICs. The two case studies help to show the role of this sector in boosting economic and social development. The candidate sees the growth of the informal sector as an important stage in the development of an economy. Individual workers can also view the informal sector favourably, even if it may at the same time prevent a rise in their standard of living. This answer covered a number of the salient points, sufficient for the top band. A little more detail was needed on the nature of the informal sector and its relative contribution to the economy. The conclusion was sound.

Mark awarded = 17 out of 20

Environmental management

If answering this option, answer Question 4 and **either** Question 5 **or** Question 6.

4. Photograph A shows construction of an oil pipeline through the Amazon rainforest in Ecuador, a MIC in South America, in 2003.

a) Outline **two** ways in which indigenous people living in the rainforest might be impacted by the construction work, giving evidence from Photograph A. [3]

The construction of the oil pipeline through the Amazon rainforest could have a serious impact on the hunter gatherer lifestyle that the indigenous population have. Not only does the pipeline form a physical barrier but the land either side is likely to be protected, stopping them from travelling across their normal hunting areas. A second impact is the loss of their traditional way of life, particularly when some Amazon tribes have only recently come into contact with elements of the modern world. The young people within the tribes may be influenced to change their clothing or habits, resulting in a loss of culture and traditions over time.

b) Explain the ways in which the rainforest environment may be at risk of being degraded by construction of the pipeline. [7]

The construction of the pipeline through the Amazon rainforest will cause deforestation; both through the area cleared for the pipeline itself and for the infrastructure required to support construction. The deforestation, alongside the use of heavy machinery to construct the pipeline, will have a serious impact on the soil in the area causing it to be compressed or eroded away due to the lack of plant roots holding the structure together. On top of the damage to the soil structure, the machinery will also cause air pollution leading to local disturbance to flora and fauna. Finally, the removal of trees and other vegetation will have an immediate and significant impact on wildlife in the area. Migration and movement patterns of animals may be affected and animals such as the Gold Lion Tamarin would be forced to come down from the trees to cross the pipeline, potentially exposing themselves to land based predators. Pollination of flora could also be affected by the physical barrier created by the clearance.

Examiner comment

Question 4(a)
A number of points were included, with at least two supported by evidence from the photograph.

Mark awarded = 3 out of 3

Question 4(b)
This answer includes a range of valid points which are well linked to the impact on the environment, specifically vegetation, animals, soils and drainage. Cause and effect are clear and a sound understanding of the rainforest environment is demonstrated.

Mark awarded = 7 out of 7

5. To what extent do the ideas of sustainability and energy security form part of the electrical energy strategy of **one** country that you have studied? [20]

Sustainability, as defined by the Brundtland report is 'development which meets the needs of the present without compromising the ability of future generations to meet their own needs'. Energy security is the association between national security and the availability of natural resources for energy consumption. Access to cheap energy has become essential to the functioning of modern economies but the uneven distribution of energy supplies in some countries has led to significant vulnerability. This careful balance between security and sustainability is an important feature around the world and one which needs to be addressed using renewable sources if the issues of human-induced climate change and resource depletion are to be addressed. I will be using the example of Germany to show how energy security can be tackled. Germany is the fifth largest consumer of energy in the world and yet it is a country which does not possess any large hydrocarbon reserves. Germany is now promoting the ideas of sustainability and energy security to the forefront of their electrical energy generation, although I will argue they are not yet being fully achieved.

Between 2005 and 2015 Germany reduced their use of natural gas from 22.7% to 8.8%; which allowed them to address the energy security issue of importing such a large volume of natural gas as well addressing the use of a heavily polluting fossil fuel. Linked to this, oil use has also dropped dramatically, also benefiting energy security and increasing sustainability.

Had the energy need created by the reduction in oil and gas use been met solely by the increased use of renewable energy, Germany would be in an exceptionally strong position in terms of their electrical energy production. In reality, some of this difference has been covered by the use of coal which has an 18% share and lignite which has a 24% share of the electricity generation mix. Lignite does have benefits to Germany's energy security because electricity production from lignite does not require government subsidies and it is produced close to the consumer and stems from a domestic raw-material source that will be available on competitive conditions and in large amounts for many decades. The lignite reserves in Germany that are economically mineable are greater than the entire oil and gas deposits of Europe. One of the lignite mines is the Garzweiler opencast mine where lignite is deposited in three seams which, together, are 40m thick on average. The lignite mined here is used entirely to generate electricity in the nearby plants. This is positive for Germany's energy security but not in terms of sustainability as not only is lignite volatile and very difficult to transport, but it is also an energy-intensive, high-polluting fuel source which has a significant impact on the environment. Although the lignite reserves have been recorded as being extensive, there

will eventually be the issue of resource depletion which will also create future issues in Germany if not addressed.

One clear improvement in Germany's electrical energy generation is in terms of their use of renewable sources, which climbed from around 10% in 2005 to 30% in 2015. Germany is one of the leading countries in the world in promoting renewable energy, which as has already been discussed, is essential for energy security and global sustainability. Renewable energy is an important industrial sector in Germany they are leading developments, alongside China, in hydroelectricity and wind turbines. The physical and precipitation characteristics in the pre-Alpine region of Germany are very favourable for hydroelectric energy generation which is part of the reason that this has been invested in by the government. The large-scale investment in wind power has also allowed over 60 000 jobs to be created in this sector, contributing to sustainability, energy security and the general economy. An essential part of this development has involved government legislation which was implemented in 1991 to promote wind energy. Without this, it is unlikely the country would be meeting over 13% of their electrical energy generation through offshore and onshore wind farms. Although China has now overtaken Germany in the photovoltaic industry, they still generate almost 6% of their electrical energy in this way as well as a further 7.7% from Biomass. All of these different renewable energy sources are essential for Germany if they are to continue to develop energy security and sustainability.

In conclusion, Germany has made significant improvements in their energy security and sustainability over the last 10 years and has managed to reduce their dependence on other countries rapidly. This has not fully addressed all sustainability concerns though and they will have to continue to invest in and grow the use of renewable energy sources if they are to further reduce their use of gas, oil and, most significantly coal and lignite.

Examiner comment

Question 5
This is an effective answer which reviews sustainability and security in terms of Germany's energy policy. Detailed knowledge and understanding of electrical energy sources and the role of renewable energy are demonstrated. There is sound evaluation of the extent to which sustainability and energy security inform German energy policy. A little more focus on how sustainability has environmental, economic and social dimensions and the role of public opinion (in the recent nuclear debate) and government planning policies would have allowed the candidate to further increase their mark.

Mark awarded = 18 out of 20

6. With reference to one or more examples, evaluate why it is difficult to improve the quality of a polluted environment? [20]

It can be difficult to improve the quality of polluted environments, and this is particularly apparent in LICs and MICs where a number of factors compound the issues due to pollution. Dharavi in Mumbai, India (an MIC) is one of the world's largest slum developments and a clear example of the difficulties involved in improving a polluted environment. The slum settlement is estimated to house up to 1 million residents and this population is increasing rapidly, with up to 300 families arriving in Mumbai every hour. This exceptionally high population growth is one of the factors that puts increasing pressure on the environment of Dharavi and also makes it difficult for improvements to be made as it is a challenge simply to keep up with the speed of growth. In many developing countries, this is the most significant issue with improving and overcoming pollution issues because the pace of rural-urban migration leaves governments and other organisations unable to make changes at a fast enough rate.

A second issue in Dharavi is the volume of people living there which leads to the generation of large amounts of waste. Efficient sewerage systems do not exist and where open sewers do occur they are often next to water pipes for drinking. When the water pipes crack, they take in sewage, which contributes to the 4,000 cases a day of diphtheria and typhoid. The whole of Dharavi slum is built on an old rubbish tip, known to contain toxic waste, including heavy metals. Although India is rapidly developing, the cost involved and the management required in reversing these pollution issues are substantial. The size of the population and therefore the speed of deterioration in these urban areas exacerbate the issues.

The management of pollution in Dharavi raises the issue of involving numerous stakeholders and their differing attitudes. Large scale redevelopment plans for the slum which would address some of the largest pollution issues, like waste and water pollution, have been met with opposition. The Dharavi Redevelopment Project proposed that the area would be completely cleared, cleaned and replaced by high rise apartment blocks and new business areas. Local people with the support of The Society for the Promotion of Area Resource Centres (SPARC) have strongly opposed these plans due to the loss of community spirit and well-established housing that many people in the slum would face. Different viewpoints are a key issue in pollution management and they have the potential to not only slow down progress, but even reverse it.

China (an MIC) has significant issues with air pollution linked to their large population (over 1.3 billion), increased vehicle ownership and manufacturing based economy. This

issue is made worse by the country's drive to narrow the development gap and strengthen their economy. Although their coal use has been dropping (3.7% fall in 2015), China is still the largest user of coal-derived electricity, generating an estimated 73% of domestic electricity production in 2014 from coal. This huge demand is largely fuelled by coal mines within the country. Some of the mines in China have been closed down over the last ten years due to poor practice and pollution but coal is still the major source of energy. The Chinese government have made significant efforts to address pollution in the country but the amount of coal being burnt generates unprecedented levels of carbon dioxide, nitrogen oxides and particulate matter. Significantly reducing coal use in China would negatively impact on businesses and residents because there is no other source of energy currently available to meet their exceptionally high demand. For the government there is a difficult balance between improving the environment and supporting the economic growth of the country.

Overall, there are a range of reasons, across a variety of scales which make it difficult to improve the quality of a polluted environment. The key issue is that both individuals and governments are often focused on economic development which can be at odds with environmental development. For example, rapid population growth due to migration for improved economic prosperity and the contrasting opinions of stakeholders can make dealing with polluted environments difficult. The most developed countries in the world may be the most effective at balancing economic and environment development now but that doesn't mean that they did not have problems dealing with polluted environments historically when they were rapidly developing.

Examiner comment

Question 6
This is a sound answer, although it might have been more effective to focus on one of the case studies, such as Dharavi as this gave a clearer picture of a polluted environment. Having said that, both case studies showed why a variety of pollution types were difficult to clear up. The explanation covered time, scale, cost, stakeholder views and the priorities of governments. The candidate supplied a good conclusion that linked the issue to sustainability and the tension between environmental and economic goals. There were some insightful comments demonstrating good knowledge and understanding of the topic. Clearly a top band answer.

Mark awarded = 20 out of 20

Global interdependence

If answering this option, answer Question 7 and **either** Question 8 **or** Question 9.

7. Fig. 2 shows government aid from HICs, 2000-09.

a) Describe the changes in government aid shown in Fig. 2. [4]

Figure 2 shows that bilateral aid increased from 44 to 75 US $ billions which is an increase of 31 US $ billion in total and the greatest rise of all four types. Multilateral aid has a slow but steady increase of 8 US $ billion over the nine years. Humanitarian aid more than doubled from 3 to 7 US $ billion and debt relief actually ended on the same amount, despite a rapid peak in 2005.

b) Suggest reasons for the changes in government aid you identified in **(a)**. [6]

It is likely that bilateral aid increased the most because of increased globalisation and interdependence. This type of aid is often 'tied' and can be based on historic links between the countries: England and Bangladesh are a prime example. The DFID in the UK controls bilateral aid in a number of different ways and there has been a steady increase in the amount of tax money that is used each year to provide this. Events such as the Boxing Day Tsunami (2004), Cyclone Sidr (Bangladesh, 2007) and the Sichuan earthquake (2008) have meant that HIC governments have had to support a number of poorer countries to recover and rebuild. Humanitarian aid didn't increase rapidly but there was an overall increase of 8 US $ billion, despite a slight dip in 2007. The dip in 2007 is likely to correspond to the global economic recession which meant that there was slower economic growth in HICs and people may have been less willing or less able to donate to causes in other countries. Part of the reason that debt relief peaked between 2004 and 2007 is linked to the Multilateral Debt Relief Initiative that was launched to provide additional support to Heavily Indebted Poor Countries (HIPC) to reach the Millennium Development Goals. Although these HIPC countries will still be receiving some debt-service relief over a longer period of time, the initial surge around the time of the new initiative has fallen back to normal levels.

Examiner comment

Question 7(a)
All changes accurately described and supported with data from the resource.

Mark awarded = 4 out of 4

Question 7(b)
All four changes were explained, with a clear appreciation of the differing nature of the four types of aid.

Mark awarded = 6 out of 6

8. "Trade has proven to be instrumental to poor countries' development. Aid has not."
Fredrik Erixon (International Policy Network, 2005)

With reference to examples, how far do you agree with this statement? [20]

Income from trade allows more revenue to flow into a country, promoting increased wealth and raised living standards. Aid can be supplied through bilateral, multilateral and NGO routes and can be used to address critical short and long-term issues. Overall I think that Fredrik Erixon's statement is partially correct because trade does have the ability to have an impact on development but I also think that the role of properly implemented aid can support development too.

If trade is freely and fairly regulated it can promote a country's economic independence and have a positive impact on quality of life. In 1990 Sainsbury's supermarket began buying bananas from the Windward Islands, under the Fair Trade Scheme. 26 years later, all of the bananas that they sell are Fair Trade which means that producers are guaranteed a price that is higher than the world market price and also receive a social premium to support community projects. In St Lucia the benefit of this can be seen in local communities. Improvements include the installation of fresh running water at the rural Richford School, an IT resource centre at St Peter's infant school and a sterilising machine at the hospital in Dennery. This is in addition to increased local employment which has started the multiplier effect. These improvements show the importance of trade and the significant economic development that can occur as a result. These changes have directly impacted on the quality of life and supports the idea that trade is instrumental to poor countries' development.

Successful trade is often dependent on changes in a country such as the adoption of Western-style capitalism, economic growth 'trickling down' enabling new industry to be established as well as the promotion of free trade. There are also barriers to the effectiveness of trade as a means of economic development. Issues such as the HIV/AIDS pandemic and lack of political stability can undermine the potential benefits of trade. Uganda is an example of a country where trade has not supported development. During political instability in the 1970s, Uganda's economy collapsed, leaving a subsistence economy with small, poor farmers making up the majority of the country's population. The country aimed to move from a primary export, aid-based economy to one with secondary and tertiary sectors. They aimed to do this by adding value to their crops, but this process has not been successful. The loans accepted by the country in 1987 from the IMF came with structural adjustment conditions, including trade liberalisation but this did not lead to more wealth for the farmers. Joining the WTO in 1995 also failed to overcome a number of the issues because organisations like the EU

subsidise their own farmers. Even the Economic Partnership Agreements aimed to promote sustainable development in LICs by enabling access to EU markets (2001) is yet to have had any major impact on Ugandan industries. This suggests that trade is not always the solution to poor countries' development, especially if other problems limit trade development.

In 1981, all wealthy countries agreed to donate 0.7% of their GDP to international aid but only five countries had reached that target by 2008. There is still a large amount of money donated through bilateral, multilateral and NGO based aid across a range of schemes. Different types of aid can be more effective than others in promoting development in poor countries. An example of this is the bottom-up, bilateral aid funded Grameen Bank which is a micro-finance project providing loans to support a wide range of enterprises, particularly in the garment industry. It is estimated that the Grameen Bank and other similar schemes have 5 million borrowers, 90% of which are women. These loans have provided a livelihood outside of farming in 28,000 villages in Bangladesh and have been seen as a wide scale success. This type of aid works carefully to promote trade and therefore is a successful method to address development in poor countries.

Critics of aid as a means towards development point out that aid does not always reach those who need it most and it is not always used effectively because of corruption. In countries such as Myanmar, a lack of basic infrastructure means that it is often difficult to use aid effectively. Aid dependency can be created and this has been seen in Haiti, where the agricultural economy has all but collapsed after years of aid support undermining the local employment structure. Aid can also often come with restrictions where the recipient agrees to conditions laid down by the donor such as 'tied' aid. All of these issues highlight that aid can actually be detrimental to the development of a poor country, if it is not managed and controlled very carefully.

In summary, trade is a more effective long-term solution for poor countries' development because it creates jobs for local people, which has a positive multiplier effect. The development of trade is not an infallible strategy to promote development, as shown by the issues that Uganda has faced and continues to face. Aid can also be used effectively to address development but this has to be carefully implemented and often the most successful aid can be that which actually promotes the growth of trade. Trade is the long-term solution to development as a country cannot stay dependent on aid because it creates too many other issues.

Examiner comment

Question 8
This is another effective answer to a challenging question. Trade is seen as both a problem for, and a solution to, development needs, depending on its level of fairness and regulation. Likewise, aid can either be viewed as counterproductive or indeed the 'seed corn' needed to support self-generating development. This is a well-balanced answer with useful examples included throughout. It analyses the differing sources and types of aid as well as the barriers to their effectiveness. Overall, this was a well-structured answer that offered a clear evaluation in a sound conclusion.

Mark awarded = 20 out of 20

9. Asses the view that, for tourist destinations, the impacts of tourism on the environment are greater than its impact on society. [20]

Tourism has become a major global industry accounting for over 9% of global GDP, 6% of global exports, 30% of global service exports and employing over 275 million people worldwide and is set to expand rapidly in the future. With over 1.135 billion tourist arrivals in 2014, tourism has both positive and negative social, economic and environmental impacts on almost every country in the world.

There are significant positive and negative impacts of tourism on both the natural and man-made environment. The impact on the natural environment is especially significant in areas where tourist activity is directly linked to features of the natural environment. Landscaping and improvement to the built environment have often occurred in an attempt to make these areas more attractive to tourists. This has a positive impact and improves the quality of the environment. Sustainable tourism, which involves development that meets present needs without compromising on prospects for future generations, has become more significant over recent years. The designation and management of protected areas has focused attention and effort for supporting natural environments under pressure from tourism. The WTTC and Earth Council drew up an environmental checklist for tourist development which has encouraged destination countries to focus on the sustainable use of the natural environment. As tourists have become more environmentally aware, the demand for sustainable and eco-tourism has increased. In this way tourism has had a positive impact on the environment.

Tourism can, and often does have a negative impact on the environment. The pressure on governments whose countries have popular tourist destinations (especially those in low and middle income countries) to encourage as many tourists as possible has meant that the environment has often been exploited to maximise tourist revenue. In Belize and Costa Rica, coral reefs have been blasted away to enhance water sports. In the Philippines and the Maldives, dynamiting and mining of coral for resort building materials has damaged fragile reef ecosystems and depleted fisheries. Other negative environmental impacts such as footpath erosion, the loss of mangrove swamps, increased pollution, water shortages and loss of wildlife habitats has been significant. Many of these impacts are caused by the construction of infrastructure such as roads and airports, and of tourism facilities, including resorts, hotels, restaurants, shops, golf courses and marinas.

The impacts of tourism on the environment are often easy to see. The physical evidence

that the environment has been improved or degraded is clear. However the impacts of tourism on the social and cultural aspects of society are often significant and widespread, but not necessarily as visible. Many communities in low income and middle income countries have suffered considerable adverse social effects linked to the presence of tourists. While the income from tourism can have a real benefit on the lives of local wage earners and tax payers (through the multiplier effect), many of the social and cultural effects of tourism outweigh these benefits.

Local people have to respond to the demands of tourists, unintentionally changing their culture and traditions, for example where religious rituals and festivals are adapted to meet tourists' expectations. Demand for souvenirs, art and entertainment can also cause local people to adapt to suit demand. Sacred sites and objects may not be respected when they can provide an income from visiting tourists. Cultural clashes also occur as a result of differences in culture, ethnicity and religion, values, lifestyles, language, and levels of wealth. The attitude of local residents towards tourism development moves through the stages of euphoria, where visitors are very welcome, to apathy, irritation and antagonism, when anti-tourist attitudes begin growing among local people (Doxey's Index of Irritation). In addition, the difference in wealth between local people and tourists can cause tension and resentment, leading to the exploitation of tourists or crime against tourists. Tourists often, out of ignorance or carelessness, fail to respect local customs and moral values. This is often the case in Muslim countries where strict standards exist regarding the appearance and behaviour of Muslim women. Tourists in these countries often disregard, or are unaware of these standards. As a result they often commit cultural taboos like ignoring the expected dress code, sunbathing in revealing swimsuits or consuming alcohol openly. Besides creating ill-will, this kind of behaviour can be an incentive for locals not to respect their own traditions and religion anymore, leading to tensions within the local community.

It is clear that the impacts of tourism on a society are substantial. The traditional values and practices of local people are undermined and even changed in response to the expectations of tourists. The conflict that occurs between local people and tourists is often unintentional but significant. In terms of the number of people and tourist destinations affected, it is clear that the influence of tourism on society has a far greater impact that the impact of tourism on the natural and man-made environments.

Examiner comment

Question 9
This answer touches on many of the positive and negative impacts of tourism on both environments and populations. There is some limited use of examples to support the points made. There is sufficient range of ideas and evaluation to warrant the top band, but some of the points could have been more developed. More detailed examples and a stronger conclusion, for example, one which acknowledged that the impacts of tourism may vary with the type of tourism and/or location (such as LIC versus HIC) would have placed this answer at the top of the band.

Mark awarded = 17 out of 20

Economic transition

If answering this option, answer Question 10 and **either** Question 11 **or** Question 12.

10. Fig. 3 shows foreign direct investment (FDI) into China, an MIC in Asia, in 1992 and 2006.

a) Describe the changes in FDI shown in Fig. 3. [4]

Figure three shows a significant increase in the number of inward sources between 1992, where there are 5, and 2006, where there are 21. These additional 16 sources come from a wider spread of countries, including those in Europe and also others such as Australia and Samoa. With this overall increase in the number of sources of FDI there has also been an increase in the scale with countries such as the USA increasing from US$ 0.5 billion in 1992 to US$ 5 billion in 2006 and Japan from US$ 0.5 billion in 1992 to US$ 7 billion in 2006.

b) Suggest reasons for the changes you described in **(a)**. [6]

Figure 3 shows clear evidence of globalisation as demonstrated by the increased number of sources of FDI to China, some of which are from developing economies. China is likely to have seen increases in the number of inward sources due to its development as a BRIC country and one of the most rapidly developing NICs in the world. This means that countries and TNCs see China as a lucrative investment with its large-scale manufacturing operations. The increase in the scale of FDI can be credited to the development of global finance which has been made possible by the huge advances in technology leading to an ever more interconnected global market.

Examiner comment

Question 10(a)
A number of changes are accurately described and supported with data from the resource.

Mark awarded = 4 out of 4

Question 10(b)
A concise answer that accurately explains the increase in sources of FDI and the expansion in total FDI. Clear knowledge and understanding are demonstrated.

Mark awarded = 6 out of 6

11. Assess why the activity of transnational corporations (TNCs) is greater in some countries than in others. [20]

Transnational Corporations (TNCs) are involved in a number of different activities and have a major influence and impact on the global economy. In total there are over 100,000 TNCs worldwide but these are not equally spread across the globe due to factors such as their home nation, production costs, trade blocs and constraints. This means that the volume and types of activity of TNCs varies between different countries, this is particularly apparent in LICs where some have little or no TNC activity (e.g. Syria) and others have a wide range of TNC production set up there (e.g. Vietnam).

The ten largest TNCs were founded in Europe, the USA, China and Japan and the majority of those in the top one hundred are also found in HICs. As companies often maintain their headquarters in the city where they started, a large percentage of TNC headquarters are based in HIC countries. An example is Wal-Mart, with their main headquarters in Arkansas whilst electronics are produced in China and clothes production in India with offices in these countries to oversee these. This also means that HICs have played a significant role in the geographical spread of Foreign Direct Investment (FDI). LIC and MIC TNCs are starting to develop as shown by companies such as Infosys, a global ICT TNC with its origin and headquarters found in India. This means that TNC management activity is currently greatest in HICs but that this may evolve in the future to show a more even distribution.

A second important factor in the distribution of TNCs is the location of manufacturing in other countries. TNCs will eventually outgrow production in their own country and source other countries to operate in, often in order to take advantage of cheaper labour. This can also allow them to exploit exchange rates, therefore maximising profit. Nike actually do not manufacture any of their own clothing or shoes for sale, instead they choose to contract the work out to South Korea and Taiwan, who then sub-contract into LICs such as Vietnam and others in the rest of Asia. In total Nike are responsible for 650 000 workers in 700 worldwide factories, 75% of which are found in Asia. Poorer Asian countries have significantly more manufacturing plants than other LICs. This is in direct contrast to LICs in Sub-Saharan Africa where there are far fewer, reasons for this will be explored later in this answer.

Another, not as fundamental but still important reason that TNC activity is greater in some countries than in others is the grouping of nations in trade blocs. TNCs can circumnavigate trade barriers by setting up inside elements of their operation within

trade blocs, also allowing them to access new potential markets. Nissan have set up a production factory in the UK in order to avoid import and export taxes in a country where their cars are sold, and also to give them access to wider EU trade. Wal-Mart are another TNC who have operated within a range of trade blocs by purchasing other companies that allow them access to markets, such as ASDA in the UK, Bompreco in Brazil and Seiyu in Japan. Not being in a trade blocs can have a significant impact on FDI into a country, as without the benefit of market access, there is less reason for foreign investment.

The final factor that I want to consider is the constraints on TNC operation. Countries marginal to the global economy can be unattractive to TNCs for FDI. As TNCs are the main source of FDI, this can be critical to these countries as other development options are limited. The reasons that countries may be unattractive and marginalised can include political unrest, conflict and natural disasters. McDonalds is a TNC which has sales points in 119 countries in the world but noticeable exemptions include both North Korea and Syria, both of which are very unstable countries.

It is clear that TNCs favour some countries over others with current patterns often showing headquarters being based in HIC countries, although this is changing as the nature of TNCs develops. TNC production tends to be focused in MICs and LICs where preferential rates and laws can be used to maximise profits. The reasons for TNC activities are interconnected, as is the nature of the globalising economy, but some factors play a larger role than others.

Examiner comment

Question 11
This is an interesting answer that blends two different approaches to the question. Both the type of activity – HQ, R & D, manufacturing – and a range of environmental, economic and political factors that influence both the type and level of activity of TNC are considered. A range of supporting examples are used, covering both TNCs and the countries they operate in. The answer is well structured and logical, clearly assessing why TNC activity varies. A clear conclusion is included but it could have suggested which factor was most dominant (the role of cost minimisation by TNCs).

Mark awarded = 18 out of 20

12. 'Overall, GDP is the best way to measure social and economic wellbeing.'
How far do you agree? [20]

Wellbeing is a general term for the condition of an individual or group linked to their social, economic, psychological, spiritual and medical state. I do not agree that GDP is the best way to measure social and economic wellbeing, although it is a key indicator to view economic change within a country. I think that wellbeing needs to be measured with a more rounded overview of development because GDP, when used alone, offers a limited viewpoint and can at times be misleading. This answer will address economic and social indicators, PQLI and HDI and use these ideas to justify the idea that GDP is not the best measure.

Economic development considers the levels of wealth, trade and debt of a country. The measures often used to assess this include GDP (the total value of goods and services a country produce a year), GNI (the total value of goods and services people of a nationality produce a year) and GNP, which is usually used in the same way as GNI. All of these can be looked at as a total sum but also per person which allows a more valid comparison between countries when their total populations are very different. These measures can provide a clear overview of how the wealth of a country changes over time. The pattern usually seen is that as country's level of development increases, the number of people living in poverty usually decreases. However, this is not always the case. In Nigeria 50% of the population live in poverty despite it being the 3rd biggest economy in Africa. Nigeria ranks 160th out of 177 countries on the scale of the Human Development Index (HDI), suggesting that in this case wealth is a poor indicator of social and economic wellbeing. These economic development indicators also fail to take into account variations in living costs between different countries which can also have an impact on well-being.

Social indicators of development, including demographic, cultural and political indicators are not accurately represented by exploring just the GDP of a country. These measures, which include healthcare, sanitation, education, life expectancy, political freedom, democracy and equality, are essential for assessing the wellbeing of a population. One social indicator is the literacy rate of a population which does not always correlate to GDP: Sri Lanka has a higher rate of literacy than Saudi Arabia, despite a lower GDP per capita. This inability to show social and economic wellbeing with GDP alone is particularly an issue when comparing individuals within a country because GDP fails to show up elite groups in the population and the fact that the gap between the richest and poorest people within a number of countries is increasing.

There are measures of development which are better ways to measure social and economic wellbeing, such as HDI and the Physical Quality of Life Index (PQLI), both of which attempt to measure the development and wellbeing of countries using multiple criteria. The PQLI is the average of three statistics: basic literacy rate, infant mortality, and life expectancy at age one, all equally weighted on a 0 to 100 scale. Although now relatively dated, the PQLI offers a rounded view of development but does fail to include any direct measure of wealth. HDI is a composite index combining life expectancy at birth, mean years of schooling, expected years of schooling and GNI per person, giving a total value up to the figure of 1.0. HDI is the more modern of these two measures and it is better than analysing GDP alone because no single measure of development can provide a complete picture of the differences between countries.

In summary, GDP is not the best way to measure social and economic wellbeing. It does offer an insight into the wealth of a country but this can mask disparity within a country and also often fails to directly account for the wellbeing of the population because money alone is not the sole deciding factor in a population's happiness.

Examiner comment

Question 12
Clearly only a limited number of indicators of well-being can be looked at in the time available and this candidate has grouped them to provide an effective structure to their answer. GDP is considered along with some of the other economic indicators, followed by social, demographic and political indicators. The answer then goes on to look at more effective combined indicators such as HDI. Examples are given for all of these indicators. The whole issue of accuracy and reliability of such indicators is considered. A sound conclusion draws together the discussion and makes a clear assessment.

Mark awarded = 20 out of 20

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