END OF SECTION QUESTIONS

Notes for answers

1 Water and carbon cycles

1 a **Water balance:** This refers to where inputs of precipitation (P) are balanced by outputs in the form of evapotranspiration (E) and runoff (Q) together with changes to the amounts of water held in storage within the soil and groundwater (ΔS):

$$P = E + Q + \Delta S$$

When precipitation exceeds evapotranspiration, this produces a water surplus. Water infiltrates into the soil and groundwater stores (passing below the water table). When pore spaces are saturated, excess water contributes to surface runoff. When evapotranspiration is greater than precipitation, evapotranspiration demands are met by water being drawn to the surface of the soil by capillary action. Groundwater stores are depleted and runoff tends to be reduced.

b **Carbon budget:** This refers to the balance of carbon exchanges between the four major stores of carbon (lithosphere, hydrosphere, atmosphere and biosphere). The current carbon budget shows a net gain of 4.4 Gt of carbon per year in the atmosphere, mainly through rising levels of CO_2 and other greenhouse gases such as methane. Atmospheric CO_2 reached 142% of the pre-industrial level in 2013, primarily because of emissions from combustion of fossil fuels and cement production. Relatively small contributions to increased CO_2 come from deforestation and other land-use change, although the net effect of terrestrial biosphere fluxes is as a sink, at 2 Gt per year. The average increase in atmospheric CO_2 from 2003 to 2014 corresponds to 45% of the CO_2 emitted by human activity, with the remaining 55% removed by the oceans and the terrestrial biosphere.

2 Two examples:

- **Deforestation** removes water-absorbent forests, which trap and transpire rainfall, and replaces them with arable or grazing land. Consequently there will be a significant increase in both the volume of water reaching a river and the speed with which it travels.

- **Changes to farming practices**, such as more emphasis on arable farming, have created a greater flood risk. This impact varies according to the seasons, however. In late autumn, winter and early spring, crops are dormant and the soil is relatively bare. Rain falling on these surfaces will not be intercepted by vegetation, and hence overland flow rates are relatively high. By contrast, in late spring and summer, arable landscapes have fully established crops that can intercept much greater proportions of the rainfall and thereby reduce peak flows, extending lag times.

3 First, identify clearly the drainage basin being studied, and provide some context, such as its size, shape, underlying geology and general vegetation or urban cover.

Second, refer to the impact of precipitation on *each* of the:

- stores — vegetation, surface, soil and groundwater
- transfers — throughfall/stemflow, infiltration rates, percolation rates, overland flow, throughflow and groundwater flow

Also discuss aspects such as intensity of rainfall and the role of seasons.

Make sure you give some specific detail of your named catchment area.

4 Note that a named case study is required.

Any potential impacts that are reasonably derived from the chosen human activities within a named drainage basin are allowed. You should also recognise the unique characteristics of the chosen case study and how human activity has impacted/is impacting on this basin.

Farming is likely to feature strongly in your response. Forest clearance for arable and pastoral farming reduces interception. There is likely to be more water in the drainage basin as a result of a lack of vegetation coverage. This may increase surface runoff and heighten the 'flashiness' of the storm hydrograph. Infiltration may be lower where soil compaction has occurred, which will again increase the amount of surface runoff.

Land-use changes may also be considered as valid human activities — building of settlements in particular will have an adverse impact on the drainage basin hydrology, decreasing lag time to peak discharge as a result of urban drainage and a lack of infiltration. You can be expected to refer to increasing flood risk here.

Water abstraction is another valid activity. This lowers the water table and reduces the discharge in rivers. You could consider some negative impacts of this.

Make sure you give some specific detail of your named catchment area.

You could include the use of field data in support.

5 Photosynthesis is an integral element of the carbon cycle:

- CO_2 is taken in from the atmosphere by plants
- this reacts with chlorophyll to create carbohydrates such as glucose; the glucose is used in processes related to plant growth or stored as starch
- oxygen is released as a by-product of photosynthesis; this process, in part, maintains the balance between carbon and oxygen in the atmosphere
- you could consider plant growth taking carbon out of the atmosphere (with possible reference to carbon sinks)

6 There is a large number of storms events to which you can refer. You might consider diverse and/or connected issues, such as El Niño or tropical storms. Your response should consider the impact of changes to the carbon cycle through deforestation and the burning of fossil fuels. You could also consider natural variation, such as forest fires and volcanic eruptions.

If you argue in support of the link between changes to the carbon cycle and increased storm events, your response is likely to consider the impact of increased temperatures on sea temperatures and evaporation rates. This, combined with the changes to atmospheric circulation (particularly jet streams), is likely to place more water vapour into the atmosphere, leading to more intense downpours through storm events.

You should refer to increased levels of CO_2 in the atmosphere leading to a more enhanced greenhouse effect, higher temperatures and therefore greater levels of evaporation.

In addition, you might argue against the idea of increased storm events — higher temperatures are also leading to increased evaporation on land. The problem of desertification in continental interiors is set to be another extreme challenge affecting places that are already arid. In other words, changes to the carbon cycle are also linked with the spread of aridity.

Conclusion needed: There must be an overall view as to whether changes in the carbon cycle will lead to increasingly severe storm events.

7 Current state of major stores of carbon:

- the lithosphere stores carbon in marine sediments and sedimentary rocks, soil organic matter, fossil fuel deposits and peat

- the hydrosphere stores carbon in the surface, intermediate and deep layers of the ocean, and the living organic matter in the water
- the biosphere stores carbon in the Earth's living matter, including living vegetation, plant litter, soil humus, peat and animals
- the atmosphere has a limited amount of carbon in storage — note its significance as the greenhouse gas CO_2

The movement of carbon between stores via a range of natural transfers (fluxes):

- if more carbon enters a store than leaves, it becomes a net carbon sink; if more carbon leaves than enters, it is a net carbon source
- natural factors contribute to changes in carbon stores with interactions with the rock cycle over geological temporal and spatial scales, include weathering, burial, subduction and volcanic eruptions, which control atmospheric and lithosphere stores
- the transfer of atmospheric carbon as CO_2 to the surface dissolved in precipitation, forming weak carbonic acid that weathers surface rocks as it transfers as overland flow to the ocean store
- the transfer of carbon in the ocean from the surface layers to the depths by marine organisms, the carbon-based skeletons of which accumulate as sediments on the bed
- the process of burial by further layers of carbon-rich sediments eventually stores carbon as limestone — the build-up of layers of coral also stores carbon as limestone
- over time tectonic uplift can bring buried stores of carbon to the surface. Subduction at plate boundaries transfers carbon-rich sea-floor sediments deep into the Earth — tectonic processes then transfer CO_2 back to the atmospheric store
- photosynthesis takes CO_2 from the atmosphere, storing carbon in the biosphere as organic matter. This operates at all scales, from tiny phytoplanktonic organisms in the oceans to continental-scale forests. Carbon is held in these stores for a range of timescales up to thousands of years
- respiration — the opposite of photosynthesis, as vegetation releases CO_2 back to the atmospheric store
- decomposition — the process by which decomposers consume organic material, which transfers CO_2 to the atmosphere store

- not all the carbon from the organic material is consumed, and some carbon passes to the soil to be stored
- combustion — transfers CO_2 to the atmosphere as a by-product when organic material is burned in the presence of oxygen; natural occurrences of this include wildfires

Conclusion needed: There must be an overall assessment as to which factors may be more or less important in controlling the size of major stores of carbon.

8 **Mitigation** refers to the reduction in the output of greenhouse gases and/or increasing the size and amount of greenhouse gas storage or sink sites. Examples of mitigation are:

- setting targets to reduce greenhouse gas emissions
- switching to renewable sources of energy
- 'capturing' carbon emissions and/or storing or burying them

Adaptation refers to changing our lifestyles to cope with a new environment rather than trying to stop climate change. Examples of adaptation are:

- developing drought-resistant crops
- managing coastline retreat in areas vulnerable to sea-level rise
- investing in better-quality fresh water provision to cope with higher levels of drought

Your answer must emphasise differences between the two concepts, with comparative statements to the fore.

9 You could use a variety of scales in response to this question. You could consider interrelationships at the level of the small-scale ecosystem, or consider regional-scale interrelationships in biomes. Another alternative relates to the global interrelationships, including atmospheric CO_2 and precipitation.

At the scale of a **local ecosystem**, you could explore concepts of fragility in relation to the impact of human activity on interrelationships within the ecosystem. For example, both the carbon cycle and the water cycle can be disrupted by a range of human activities including farming, vegetation clearing (deforestation), establishment of plagioclimax vegetation communities, and work on local rivers and the associated catchments. At this scale, you might consider positive actions to support the balance between the two cycles. You could feature afforestation and peat bog development as long as it is clear how these activities impact on the interrelationships between the cycles.

At the **regional scale**, you might consider the impact of atmospheric changes. For instance, in tropical forests, large-scale removal of vegetation is known to disrupt the cycling of water through convection rainfall. The lack of transpiration causes a reduction in precipitation rates. This in turn can cause a devastating impact on rainforest vegetation, especially tree growth. Where this occurs, the carbon cycle is effectively broken. Large-scale removal of vegetation can also impact on the soil carbon stores. The carbon stores are removed through rain-splash impact and surface runoff. Rivers carry away soil, which contains an important store of carbon. You might link large-scale vegetation removal with an increase in weathering. This can trigger slow carbon release through the weathering processes of rocks that contain carbon.

At the **global scale**, you are likely to feature increased carbon emissions. You must clearly link these to the interrelationship between the water and carbon cycles. Mitigation strategies to reduce CO_2 may feature but these must be clearly linked to the interrelationships between the water and carbon cycles.

Conclusion needed: There must be an overall statement of the *extent to which* the interrelationships are fragile and also of how any damage is irreversible.

10 Human activities are likely to cover issues associated with the exploitation of tropical rainforests, e.g. deforestation for wood, land clearance, transport and settlement. You could also feature extraction of minerals as an activity causing potentially permanent change to the carbon cycle.

In terms of expanding on the 'permanent' change aspect of the question, you could refer to the impact of deforestation on the nutrient cycle in rainforests. Once trees are removed in large numbers, the carbon cycle is interrupted. Leaf litter is no longer returned to the ground for decomposition. The humus layer is left exposed to soil erosion as the canopy no longer exists. This further weakens the soil structure due to rain-splash impact. Once exposed, eroded soil is less capable of sustaining new plant growth. This process of rainforest desertification can lead to significant damage to the carbon cycle. You might link this to an ensuing lack of convection rainfall caused by a lack of transpiration.

In terms of the notion of permanence, you could argue that the cycle will always return to equilibrium once human activity recedes. Or you might argue that damage is permanent in the sense that, for the foreseeable future, some areas have experienced irreversible loss.

Conclusion needed: There must be an overall statement of the *extent to which* human activity is responsible for permanent changes in the carbon cycle.

2 Coastal systems and landscapes

1 Coastal energy can be used for wave creation, erosion or transport.

Wind is responsible for the generation of waves as friction occurs at the surface of the water. Stronger winds blowing for a longer distance will generate bigger, more powerful/destructive waves. Wind also affects currents in terms of the direction that wind is blowing. This has a direct bearing on the potential for longshore drift, depending on the angle at which the waves hit the coastline.

2 The coast can be described as an open system. Inputs originate from outside the system, for example energy from waves and wind, and sediment from rivers. Outputs move out of the system, for example sediment accumulates above the tidal limit and sediment eroded from the coast is transported beyond the local sediment cell.

As an open system the coast is linked to other natural systems — including the atmosphere, with wind as an input of energy. Sediments that are eroded from the coast are transported into deep oceans and become part of geological systems, with dissolved carbon from chalk and limestone cliffs moving through the carbon cycle.

3 Tides are the periodic rise and fall in the level of the water in oceans and seas, and are the result of the gravitational attraction of the Sun and Moon. The moon has the greatest influence, pulling water towards it to create high tides. Meanwhile, on the opposite side of the sea/ocean, the tide is at its lowest. Tides run in cycles that follow the 28-day lunar cycle, therefore every 28 days the gravitational pull is greatest and this gives the highest tides — spring tides. At the point in the cycle 14 days after this event tides are at their lowest, before beginning to rise again. This lowest point in the cycle is known as the neap tide. The Sun also influences tides but to a lesser extent. When the Moon and Sun are in alignment, tides are particularly high.

4 **Eustatic** sea-level change is that which occurs on a global scale and within the seas and oceans. This may be caused by an increase in world temperatures causing ice caps to melt and increasing sea level (or conversely lower temperatures causing an increase in ice sheets and lower sea levels).

Isostatic sea-level change is on a smaller scale and is the result of more localised factors — such as isostatic rebound or tectonic activity resulting in land uplift — and so is land-based.

Your answer must emphasise differences between the two concepts, with comparative statements to the fore.

5 Your response will most likely refer to wind, waves, currents and tides, and how these shape the coastline. The key is that you assess the importance of energy in the development of the coastal landscape of choice. You are expected to refer to at least one named coastal landscape.

High-energy environments are characterised by strong winds and a large fetch, which generate strong currents and more destructive waves. These waves attack exposed coastlines, usually cliff-lined, where the water is deep and the waves can attack unimpeded by shallow water. You could refer to geos, arches, caves, stacks and stumps as characteristic landforms created in these environments. You should note the importance of wind, which in turn affects wave power.

You might assess the importance of constructive versus destructive waves and link this to the development of associated coastal landscapes.

You could consider the direction of the prevailing wind in assessing the importance of sources of energy. Provided other conditions exist at the coastline (such as shallow water and a sediment supply), you could link this to the development of beaches and spits. Again, the wind is the critical factor in the development of this landscape. These low-energy environments are characterised by low wind speeds or calm conditions in sheltered environments. Waters tend to be shallow and constructive waves dominate. The swash is more powerful than backwash and sediments are pushed up the beaches in bays. You might link this to longshore drift and the formation of spits, where local factors allow the formation of such features.

Tides may also feature as an important energy supply. You might consider estuaries and the development of mud flats and salt marshes. You might also link tides to prevailing weather conditions, and how low pressure and high tides coincide to give storm surges, which can cause significant erosion.

Conclusion needed: There must be an overall assessment of the relative importance of different sources of energy in the creation of coastal landscapes.

6 You should recognise that the last 10,000 years has been a period of global sea-level rise following the end of the last glacial period. You might note that during this period some coastlines have experienced a relative rise in sea level, while others have experienced a relative fall.

You may recognise that eustatic sea-level change has led to global rises in sea level, resulting in coastlines of submergence, with landforms such as rias, fjords and Dalmatian coasts. Reference to named examples can be expected. You could note that formerly glacial coastal regions rebounded following the loss of surface ice, resulting in emergent coastlines, including raised beaches and marine platforms. Again, named examples can be expected.

Your response might also evaluate the scale and rate of sea-level change in different coastal settings. The key is that there are clear links between sea-level change and landforms producing coastal landscapes.

Conclusion needed: There must be an overall evaluation of the role of sea-level change in the development of coastal landscapes.

7 Soft engineering includes beach nourishment, dune regeneration, marsh creation and land-use management. You could explain each of these strategies in some detail. For example:

Beach nourishment — the material (usually sand) is dredged from the seabed nearby (sometimes offshore) and placed on the beach by spraying and then reworked by machinery. Sometimes sand is taken from one end of a beach to another to replace that lost by longshore drift. This additional material acts like a natural beach and protects the foot of cliffs or the area behind the beach from erosion. Beach nourishment encourages the waves to break early and thereby dissipates wave energy before it reaches the coast.

The creation of marshes forms a natural barrier between the sea and the inhabited area behind. This is possible in many river estuaries. The area is allowed to flood and return to a more natural state, and so slow down/reduce the impact of the sea. The timing of planting has to take careful note of the spring tides to give the plants time to bed in.

8 Note that a named case study is required.

Explanation: You should refer to the specific methods adopted for the selected case study. For example, on the North Sea coast in Yorkshire:

- the presence of sea walls and groynes at Bridlington, Hornsea and Withernsea, with the latter two also having rock armour
- Mappleton has rock armour and rock groynes

- Easington has revetments

You should give clear explanation as to how the strategies work.

Commentary on effectiveness: You should refer to the extent to which the strategies reduce erosion, with possibly some comment on their impact on other sections of the coastline. You could feature the views of different people/interest groups involved. You could also refer to the environmental impact, economic viability and aspects of sustainability.

Note: The commentary should relate to the identified scheme(s) and not be generic.

9 You might take a more physical approach by examining evidence in support of the statement, i.e. that coastal flooding and erosion are set to become increasing problems. You could consider issues associated with areas vulnerable to erosion and how this is being exacerbated by coastal management strategies and local geomorphology. Climate change is also likely to feature. Your response would be likely to consider the impact of climate change on sea levels and associated expected changes to weather patterns. You could argue that these combined issues will impact on both flooding and erosion.

You could instead consider coastal management as a way of mitigating the impact of erosion and managing flooding. For coastal management, you might refer to schemes that involve hard and/or soft engineering. Hard engineering is likely to consider groynes, revetments, sea walls and riprap. Soft engineering is likely to consider beach replenishment, vegetation planting and managed retreat. The distinction between the two is in the way soft engineering attempts to manage flooding and erosion in a more natural and sustainable fashion, working more effectively with nature.

Your evaluation should consider the effectiveness of the scheme(s) and the cost. You could evaluate soft versus hard engineering in relation to environmental impact.

Conclusion needed: There must be an overall statement of the *extent to which* coastal flooding and erosion will become more common occurrences in the future.

10 Note that a named case study is required.

Your response should describe and evaluate the nature of predicted climate change, i.e. increased global temperatures, changes to precipitation patterns and increased storm activity. You might assess the impacts of these changes on coastal landforms and landscapes. This may include the impacts of increased frequency, intensity and magnitude of coastal flooding, and implications of increased rates of coastal erosion.

You should also make judgements about the challenges such changes will pose for the sustainable management of the coastal environment. This may include an assessment of the sustainability of different coastal erosion and flood protection methods.

Your response may assess the implications of predicted climate change on the population of the chosen coastal environment and the extent to which challenges posed to them can be managed sustainably. You might also assess the sustainability of possible mitigation strategies that could be used to reduce the scale of climate change. You could make judgements on the sustainability of land-use planning and integrated coastal zone management in the case study area.

Conclusion needed: There must be an overall statement of the *extent to which* predicted climate change will present challenges for the sustainable management of the area identified.

3 Hazards

1 Storm surges are a product of extreme low-pressure systems that raise sea levels by approximately 1 cm (on average) for every millibar drop in atmospheric pressure. When low pressure combines with a high tide and strong onshore winds, storm-surge conditions are created. Local and regional topography also play a part — bays, for example, have a funnelling effect.

You might refer to the combined effect of heavy rainwater associated with deep low-pressure systems, i.e. the rainfall causes flooding in estuaries, exacerbating the problem of the incoming surge.

2 Tsunamis are generated by shallow-focus underwater earthquakes (the most common cause), volcanic eruptions, underwater debris slides and large landslides into the sea.

To generate a tsunami, an earthquake has to cause a vertical displacement of the sea bed. This in turn displaces water upwards, which generates a tsunami at the ocean surface. As water depth decreases, friction between the tsunami wave and the sea bed slows the wave down. As the wave slows, wavelength dramatically decreases but wave height increases. This produces a series of huge waves, metres high. Around 90% of all tsunamis are generated within the Pacific Basin, associated with the tectonic activity taking place around its edges.

3 Convergent plate margins are often at the meeting point of continental and oceanic plates. Convection currents force the more dense oceanic plate into the less dense continental plate. Subduction occurs as the more dense oceanic plate is forced beneath the continental plate. The focus of an earthquake is often deep underground within the subduction zone. After a period of pressure build-up, movement occurs and earthquakes strike.

On land, the crumpling effect of the plates being forced into each other creates fold mountain ranges, such as the Andes. The friction of the plates being forced together forces the crust to melt and become molten. Under intense pressure the molten rock is forced to the surface through weaknesses in the rock before creating volcanic eruptions. Other hazards relate to the impact of earthquakes (e.g. landslides) and hazards associated with volcanoes (pyroclastic flows, ash clouds etc.).

4 It is thought that there are several conditions that need to be present for the formation of tropical revolving storms:

- an oceanic location with sea temperatures over 27°C — this provides a continuous source of heat to maintain rising air currents
- an ocean depth of at least 70 m — this moisture provides latent heat, rising air causes moisture to be released by condensation, and the continuation of this process drives the system
- a location of at least 5° north or south of the equator in order that the Coriolis force can bring about the maximum rotation of air
- low-level convergence of air in the lower atmospheric circulation system — winds need to be coming together near the centre of the low pressure
- rapid outflow of air in the upper atmospheric circulation — this helps drag away the warm air that has risen close to the centre of the storm

5 Earthquakes are measured by a number of scales including (in order of date of development) the Mercalli scale, the Richter scale and the moment magnitude scale.

The **Mercalli scale** measures the effects of an earthquake and has a 12-point scale.

The **Richter scale** measures the earthquake's magnitude in terms of the energy released and has a 10-point logarithmic scale. It has been superseded by the **moment magnitude scale** (MMS; denoted as M_W), which also measures earthquakes in terms of the energy released. Earthquakes of M_W2 or less are rarely felt by humans. The scale is logarithmic: an increase of one unit of magnitude increases the amount of shaking by 10, but the amount of energy released by 30.

6 The hazard management cycle provides a framework within which management of wildfires sits comfortably. The model operates within key elements — preparation, response, recovery, mitigation.

Some may argue that **preparation** requires an understanding of the causes of wildfires as well as an understanding of the typical locations where wildfire tends to occur.

Natural causes relate to lightning strikes, volcanic eruptions and sparks from a rock fall. There is also some evidence that wildfire can be started by spontaneous combustion. Human causes can be categorised as either intentional or accidental. Carelessness with camp fires and cigarettes are the main accidental causes. You could point out that intentional fire-starting is very difficult to plan for because of its random nature. Without a fuel source, however, there can be no wildfire.

Referring to hazard mapping as part of preparation for wildfire is relevant. This is used to map areas most at risk using a variety of data on vegetation type and coverage, precipitation rates, weather forecasting and historical records.

The model also proves useful in terms of managing the **response** where the use of water is crucial. The aim is to put out the fire as soon as possible. There are a variety of techniques for this, some of which overlap with preparation. For example, ensuring a substantial supply of water is readily available in affected areas is important. Also, for response, planners will have established protocols around the use of fire lines, which are measures taken to remove vegetation and isolate the fire.

In terms of **recovery**, a major factor relates to the risk of soil erosion. Exposed soil can be easily eroded by the action of wind and heavy rainfall — so measures designed to protect the soil such as straw coverage or using partially burned vegetation to cover the soil are relevant. There is also the added risk of mudflow where burning occurred on a hillside. Stabilising such slopes is another part of recovery.

Mitigation is the final strand of the cycle. In terms of wildfire this is about reducing the risk to property and the environment. There is overlap here with preparation and response. Mitigation may involve using fire-retardant/resistant building materials.

Your answer is likely to score better if you provide supporting material from one or more case studies. Specific detail is always better than just general points.

Conclusion needed: There must be an overall evaluation of effectiveness of the hazard management cycle in dealing with wildfire events.

7 Extreme events are likely to pose serious challenges for any governance, however well-planned, e.g. the 2011 Japanese tsunami. Extreme events are by their nature unpredictable (e.g. 1-in-1000-year events) and so prediction is difficult and prevention impossible. Sometimes secondary and tertiary outcomes occur, e.g. Fukushima. Disaster management — before, during and after the event — can have a significant impact on losses, e.g. compare the Japanese tsunami with the south Asian tsunami.

Strong governance can lead to very effective management of immediate disaster recovery, e.g. the Sichuan earthquake in China, as well as the development of longer-term education and community-preparation strategies. Management is expensive, however, and with long return intervals there are strains on budgets that may affect levels of investment, e.g. San Francisco and 'the big one'.

Democratic governance is also often driven by short-term budgetary constraints, which make saving money on management measures very tempting, given that these are expensive. Governance is important but it has limitations such as the affordability of prediction and prevention measures, especially in the management of mega-disasters immediately after the event, e.g. Haiti. Therefore, arguments that suggest other factors, such as level of development, are likely to be more important are valid.

Your answer is likely to score better if you provide supporting material from one or more case studies. Specific detail is always better than just general points.

Conclusion needed: There must be an overall assessment of the importance of governance in the successful management of tectonic disasters.

8 Note that a named case study is required.

The management and response largely depends on the event chosen. It is acceptable to consider the management and response in terms of preparedness prior to the event in areas known to be earthquake-prone.

One example is the **south Asian tsunami** of 2004, where preparedness, management and response were poor, leading to enormous loss of life. Lessons learned from this disaster have led to much more effective systems around early warning, tsunami shelters and coastal defences, not just in the affected area of Banda Aceh (Indonesia) and Sri Lanka, but in other areas thought to be at risk of this type of hazard.

Another example is a land-based event such as the **Haiti earthquake** of 2010, which had a magnitude of 7 on the Richter scale. Here again loss of life was substantial, preparedness was poor, structures crumbled and the death toll in the following weeks was considerable as the area struggled to cope with the secondary impacts.

In considering the response to any event, you could feature the international community, showing the way in which organisations offer humanitarian support and aid in such times of crisis. Your evaluation may consider the effectiveness and timeliness of the international community in offering support to governments and local communities.

Conclusion needed: There must be an overall evaluation of the management and response to one seismic event.

9 In a crisis following a global seismic event, factors of globalisation invariably support the response to the event. Technology is used to aid communication and transport, bringing immediate relief to affected areas. Technology allows family members to communicate across great distances, which is especially important in times of crisis where families are separated.

Countries use their own aid budgets to support seismic events as well as the combined efforts of nations in response — especially important where countries lack the resources to address the issues independently.

You should assess the value/importance of the support facilitated by global action in responding to seismic events.

For a more sophisticated response you might show awareness of the lack of consistency around the global response to seismic hazards. There is a number of complicating issues that factors of globalisation alone cannot solve. Political alliances/situations, stages of development, levels of corruption and internal conflicts are just some of the issues that hinder the response to major seismic events.

Your answer is likely to score better if you provide supporting material from one or more case studies. Specific detail is always better than just general points.

Conclusion needed: There should be some overall assessment of the importance of factors of globalisation in supporting the response to seismic hazards.

10 The management largely depends on the event(s) discussed. Strategies include:

- research into how tropical storms can be tamed — much of this effort is directed at ways of reducing the storm's energy while it is still over the ocean. One attempt has been to 'seed' the storm using silver iodide outside of the eye-wall clouds
- prediction of storms' origins and tracks — the USA, for example, maintains round-the-clock surveillance of hurricanes using weather aircraft
- better forecasting of cyclone tracks and intensities — could reduce deaths and property damage by enabling the issue of more timely and accurate warnings and evacuation orders. Scientists are also aiming to build better computer-forecasting models
- preparedness is the best form of protection — accurate predictions enable evacuation to take place and emergency services to be put on full alert
- other protection measures include: land-use planning so that areas of highest risk have limited development, and therefore less potential economic damage; strengthening of buildings to withstand storms and floods, or building houses/buildings on stilts; construction of seawalls, breakwaters and flood barriers
- adequate insurance before the disaster and aid during and after the event — contribute towards modifying any loss

Your answer is likely to score better if you provide supporting material from one or more case studies. Specific detail is always better than just general points.

Conclusion needed: There should be some overall assessment of how well the hazards associated with tropical storms can be managed.

4 Global systems and global governance

1 For example: Boeing is a global aircraft manufacturer with its HQ in Seattle, USA but it has a global network of factories and parts suppliers that promote globalised trade. This includes sourcing engines from the UK and wings from Japan. Boeing aircraft, such as the 747, are important in transporting global flows of people and some goods, so Boeing's aircraft technology contributes to the 'shrinking world' effect.

In 2017, however, it sought help from the US government to block cheaper imports of a plane manufactured in Canada (part of NAFTA), with wings made in Northern Ireland.

2 The 'shrinking world' is the result of changes in transport and communications technologies, which reduce the frictional effect of distance on movement and therefore permit time/space to shrink. Some of the technological changes that have contributed to this are:

- in ocean transport, the development of giant oil tankers, containerisation and the introduction of roll-on/roll-off methods
- in communications, the use of satellites and their ability to transmit live television images around the world and transfer business information

The 'shrinking world' concept has been enhanced by the use of information and communications technology (ICT), whereby the transfer of personal communication and data through cyberspace can be instant.

3 Globalisation is the growing economic interdependence of countries worldwide through increasing volume and variety of cross-border transactions in goods and services, freer international capital flows, and more rapid and widespread diffusion of technology.

Globalisation can be defined as a series of changes, or outcomes, for different groups of people and places. These outcomes can be compartmentalised into different dimensions — economic, social, political and cultural outcomes. You could provide some detail for each of these.

Another key feature of globalisation is the rise in global networks. Networks create connections and connections bring a range of advantages. Global networks come in a variety of forms. There are several types of network:

- business and trade — physical and financial flows
- communication — the internet being the clearest example
- transport — air travel and container/bulk shipping
- production — particularly those of TNCs
- political — especially those that focus on economic/trade ties
- demographic — flows of people

4 Outsourcing refers to when a TNC, often based in a developed country, sub-contracts an 'overseas' company, usually in a developing country, to produce goods or services on its behalf. It involves contracting a relationship with a supplier and sometimes supplying technology and technical assistance.

Challenges for the host include:

- cheap labour can be exploited with weak unions and governments
- TNCs might wield great power to influence governments
- environmental and labour laws might be poorer than in richer countries
- TNCs might move again to other countries with even cheaper labour
- tax avoidance may be an issue

Opportunities include:

- jobs in the new industries, which may provide higher pay, better conditions and more skill-learning than traditional work
- profits for the local companies involved as suppliers
- taxes paid to the government

Your answer is likely to score better if you provide supporting material from one or more case studies. Specific detail is always better than just general points.

Conclusion needed: There should be some overall assessment of the degree to which outsourcing presents challenges and opportunities to poorer countries, possibly with a view of relative weighting.

5 Some points:

National boundaries have become more open, allowing easier flows of labour. For example, the free movement of labour in the EU since the Maastricht Treaty has reduced security measures at national borders.

Initiatives, e.g. the WCO Framework of Standards for International Trade, have been introduced to increase supply chain security by ensuring that shipping cargo in transit is locked with tamper-proof seals.

Terrorism is a threat to globalisation and can interrupt the flow of goods and labour. In response to this, the USA has an organisation called C-TPAT that is focused on improving the security of private companies' supply chains. It has 11,000 members, which encourages world trade as these companies are considered low risk and trade is speeded up by less rigorous customs checks.

Cyber security is becoming an increasingly important factor due to dependence on information systems. There are initiatives to increase the level of security at both national and global scales. For example, in the UK the National Cyber Security Centre works with governments and companies to reduce cybercrime, increasing confidence in UK information systems.

The EU was established to bring greater levels of peace to Europe. This has encouraged globalisation as the threat of conflict is reduced. There are greater flows of goods and services across the EU as a result.

6 China is spreading its influence to other parts of the world through its economic power and is thereby impacting on geopolitics. China is investing heavily in other parts of the world through FDI — in 2013 its outflow was over $100 bn. China has made large investments in 'Factory Asia' — countries such as Vietnam, Malaysia and the Philippines. China is also involved with the ASEAN group of countries, and these countries are keen for Chinese influence to spread into them. One example is Thailand, which is becoming a major vehicle manufacturer partnered with China.

Elsewhere, China is investing in the USA, Brazil, Australia, Nigeria, Saudi Arabia, the UK (e.g. the new Hinkley Point C nuclear power station), and many other parts of west and east Asia and Africa.

You could provide specific detail regarding Chinese investment into sub-Saharan Africa (such as infrastructural schemes, special trade and economic zones, and in terms of aid packages regarding health and education) and the Pacific (e.g. the South China Sea). Some have regarded these investments as neo-colonial, whereas China would regard most, if not all, as being purely altruistic. Equally, some regard these investments and geopolitical moves by China as 'opportunities' rather than 'threats'. All of these views are subject to debate.

Conclusion needed: There must be an overall statement of the *extent to which* China is driving the global economic system to its own advantage and influencing geopolitical events.

7 You will be given credit for references to the activities of named TNCs and also for general points that can be applied to all, or to a range of, TNCs.

In terms of general background and impact, TNCs:

- originally developed in developed countries, but they are now increasingly based in emerging economies (e.g. South Korea, China, India, Malaysia)
- are responsible for a large proportion of the world trade in petroleum, cars, electronic goods, sports clothing, etc.

- are also responsible for transnational shipping, air travel, rail travel, financial services, software development
- have massively facilitated globalisation of the economy, with all the good and bad features that brings
- have led to falling prices of many goods in the last decades, but can also cause the disadvantages that come with monopoly or near-monopoly markets
- transfer materials and finished products from country to country, and also ideas, capital, technology, labour, culture…
- …but may stifle local initiatives and developments
- can boost economic development in countries where they are based, but can also drain resources
- can help bring foreign direct investment (FDI), but can also cause problems with tax-reduction and tax-avoidance schemes, off-shore ownership, etc.
- provide a 'business-friendly', or at least non-unionised, environment
- operate in countries with the least strict environmental and health and safety legislation

Conclusion needed: There should be some overall evaluation of the impact of TNCs on the global economy.

8 The 'global commons' refers to a tract of air, land or water owned or used jointly by the global community, which lies beyond national jurisdictions — examples include the atmosphere, the oceans and Antarctica. The World Conservation Strategy stated that all people on the planet have a right to the benefits of the global commons. For the right of all people to sustainable development, the global commons require protection.

Antarctica is under threat from climate change, and you could also consider how fishing, mineral exploitation and tourism may put pressure on the continent and the water around it. However, is there a conflict here? This sits uneasily with efforts to promote resource conservation and environmental protection.

9 Content for your response to this question might include:

- knowledge/understanding of the economic growth of the established developed economies (the USA, the EU, Japan)

- knowledge/understanding of the growth of the new large economies, particularly China and India
- knowledge/understanding of the growth of new emerging economies — e.g. Brazil, Russia, the Gulf states and the MINT countries — and prospects for these and others in the future
- critical understanding of the complexity of the global economy, and the factors that have led to globalisation
- detailed use of case study material to support the points being made

Analysis and evaluation may refer to:

- critical understanding of the causes and impacts of change in the global economy across different time scales and contexts, and the responses to them
- evidence in the breadth/depth of supporting evidence is both positive/negative, referring to different locations around the world and linking causes and outcomes to regional and national variations
- recognition of the degree to which resilience is built into established economic systems, e.g. to what extent does (regional/national) governance (or the lack of it) play a role?
- recognition of the complexity of the issue, possibly considering wider impacts and influences such as the role of key decision makers in the global economy

Conclusion needed: There must be an overall statement of the *extent to which* the global economy has moved on from the developed nations to other countries.

10 Content for your response to this question might include:

- the effects of changing carbon budgets on the seas around Antarctica, including ocean warming, ocean acidification, ocean salinity and melting sea ice
- the threats to fishing in the Southern Ocean — some species of fish are at very low levels, e.g. Antarctic rock cod
- the reduction in krill in the Southern Ocean is a major cause of concern because krill is a major food source for much of the marine ecosystem
- whaling and sealing — what is the continuing damage from historical exploitation?
- impacts of tourism in Antarctica, which has seen significant increase in recent years
- marine pollution from tourist and other sources is a threat

- pollution by tourists and the fishing industry potentially affects the Antarctic environment — discarded plastic, fishing nets and hooks, organic waste and sewage all contribute to environmental degradation
- the role of international government organisations, e.g. the International Whaling Commission, the IAATO and the UN

Analysis and evaluation may refer to:

- the effects of changing carbon budgets, with the combined pressures of global population increase, increased levels of industrialisation, deforestation etc.
- the connection with climate change and subsequent impacts on Antarctica
- attempts to reduce anthropogenic carbon emissions and the subsequent mitigation of effects on the Southern Ocean
- the difficulties of predicting precise changes in the carbon budget and the subsequent effects on ocean salinity, acidification and nutrient enrichment
- analysis of the wider threats posed by climate change associated with human activity in Antarctica — e.g. ice-cap melting, floating icebergs, as well as disturbance to ecosystems, e.g. devastation of krill populations
- analysis of the connections between the changing carbon budget and sustainable fishing/whaling in Antarctica — e.g. overfishing activities and the impacts on fish/whale stocks
- analysis of the connections between the threat from changing carbon budgets and the threat from tourism — warmer oceans may extend the tourism season, increasing pressures on landing sites
- analysis of the effectiveness of international protection of Antarctica through frameworks such as the UNEP and IWC whaling moratorium
- evaluation of the extent to which the impacts on Antarctica and the Southern Ocean may cause positive feedback loops — threats from changing carbon budgets may be a larger global threat

Conclusion needed: There must be an overall statement of the *extent to which* changing carbon budgets are a greater threat to Antarctica than tourism and fishing/whaling.

5 Changing places

1 For example: Doncaster, as depicted in the BBC series *Open All Hours*.

One website [www.imdb.com] has the following overview of the series: 'Arkwright is a tight-fisted shop owner in Doncaster, who will stop at nothing to keep his profits high and his overheads low, even if this means harassing his nephew Granville.'

The outdoor shots from the show are filmed in a district of Doncaster, Balby, where there are lines of Victorian terraced houses close to some industrial plants. The 'shop' is a corner shop within these terraced houses. The shop owner and his nephew, Arkwright and Granville respectively, are given old-fashioned and traditional 'northern' names, and they perpetuate the perceived stereotypical view of Yorkshire people — one of thrift. Other characters shown also demonstrate the straightforward attitudes of 'northern' people, and some might say the characterisation is unsophisticated and/or simplistic.

Are these 'true' characteristics of the area shown and the people within it? It is true that Doncaster does have some areas of terraced housing, but so too do most other towns in the UK. Across the country, these areas also do have corner shops and other small businesses such as hairdressers and fish-and-chip shops. Like all other UK towns, Doncaster has a mix of housing types and areas, with some exclusive new developments taking place in the Lakeside area of the town. These do not feature in the TV show. Doncaster is also in Yorkshire — do all the people of this lovely county have the same personal attributes of the characters in the show? That is for others to judge.

2 Money and investment can create employment opportunities that attract younger people to move into an area. For example, in Stratford (London) the investment for the 2012 Olympics provided jobs in the Westfield shopping centre, and large companies like BT were attracted to the area. As a result, unemployment in the nearby area of Newham has fallen.

Investment in one area can cause outward migration from another area. This can cause socio-economic decline as it is the more skilled, affluent residents who can choose to move. Investment in Stratford has caused rapid gentrification, and less affluent former residents have been priced out due to a lack of affordable income. House prices have risen by 71% since 2005 (compared with 47% in nearby boroughs), which means that young first-time buyers cannot afford housing in the area.

3 **Insider perspectives** refer to the development of a sense of place through everyday experiences in familiar settings. Daily rhythms and shared experiences are critical and they underpin the subjectivity that is the basis for the sense of place of the community. The insider's view is often about experience, a narrative of close involvement with the landscape and locale, expressing what time and repetition teach the person about that place. The insider is an inhabitant, a dweller.

Outsider perspectives occur where the sense of place is more vague and abstract. The outsider's view is often about discovery, a personal view of entering a locale or landscape and learning how an individual passes through it or how others dwell in it or how to become a dweller in it. They may also develop new opinions about the place. An outsider is often a traveller, an observer from beyond the place.

Statements of difference should be to the fore.

4 As in Question 1, you are required to consider a place you know well and discuss how a qualitative source of information assisted you in understanding or perceiving that place. Here, such sources will be examined in general:

- **A painting** may be considered less reliable than a photograph because there is more scope for individual interpretation and selection. It may show a deeper understanding of the nature of the place, however, because it allows the painter to give a personal interpretation of the character of what is there.
- **An old photograph** may show a more literal view of the place, but even a photo is selective in what it shows. Comments on changes made with photo-editing software could also be relevant. The photo may show a wider area and so provides more context for any discussion. When studying photographs, make sure you look at the background as well as the foreground.
- **A newspaper article** will initially seem accurate and specific but, depending on the reason for the article, the author may well have a degree of bias or be targeting a particular issue in that place. Hence you should always consider the standpoint of the author.

- **An interview** in isolation may also have a degree of bias as the interviewee is most likely to have been chosen (or volunteered) because they had a view to put across. When seeking to find out more about the character of a place, you should endeavour to interview more than one person. Having said this, to find out about the growth of a place then clearly an interview with someone who has lived in the place a long time will be most useful.
- **A song**, or **a poem**, is an interesting source to use. For these you will often find out about deeper emotions and feelings towards a place, or about key events in the past, and less about the built landscape.

5 As in Questions 1 and 4, you are required to consider a place, or places, you know well and to discuss how qualitative considerations/perceptions assisted you in understanding that place(s). You then need to compare this with the quantitative data you have. Your answer could deal with some or all of the following:

- the meanings of 'experienced place' and 'media place'
- the concept of 'perception' and how it compares with reality
- the concepts of 'insider' and 'outsider' perspectives (Question 3)
- the nature of the chosen place and how it is seen in different ways by different individuals and/or groups
- how and why the different individuals/groups develop their different perceptions of the chosen place
- presenting details of the quantitative data used
- analysing aspects of those data

Remember that in place studies there is no single objective truth about perception of place. It depends on an individual's view of that place, and even this can vary over time. The best answers will show an awareness of this.

6 **Endogenous factors** — those factors that are caused or originate from within, i.e. internally. In the context of places they refer to characteristics such as physical site and situation, topography, as well as the human characteristics of the local people and what they have built.

Exogenous factors — those factors that are caused or originate from without, i.e. externally. In the context of places they refer to flows of people, resources, investment and ideas into an area or location.

Statements of difference should be to the fore.

7 A palimpsest refers to a place that has grown up as a series of layers — a place that has changed over time and shows evidence of that change. A palimpsest can then be unravelled in order to develop a greater appreciation of the place. All places have past and present connections, which often mean that historical influences have shaped their development and left their mark. These connections, or influences, can be political, religious and cultural. For example, the Mezquita in Córdoba, Spain, is a Catholic cathedral built around a previous mosque — the latter is actually within the former.

8 Note that a named case study (local place) is required.

Your response to this question might include:

- the nature of the infrastructure of the place — this comprises the services essential to enable or enhance living conditions, e.g. communications such as roads, railways, canals and/or airports. Other communications infrastructure may also be included, such as broadband and phone networks, along with services such as water supply, sewers and electrical grids. Provision of parks, public pools, schools, hospitals and libraries is also relevant
- references to soft infrastructure such as the local education system, healthcare provision, local government and law enforcement, as well as emergency services
- knowledge and understanding of the chosen place and the different groups who live there
- knowledge and understanding of historical developments in the chosen place, relating to developments in communication, buildings and other infrastructure

Analysis and evaluation may refer to:

- the ways in which infrastructure may affect different people and groups, with reference to gender, age, level of education, employment type (or unemployment), ethnic group, and length of residence or employment in that place
- the effects of improved communication links on employment patterns, leisure activities, shopping, access to education and social amenities — the effects of these developments will vary between different groups in the community

- impacts of development of infrastructure that may be positive, e.g. new uses for old and often empty buildings, or clearing them away to make way for new ones; old warehouses may be converted into luxury apartments and flats; brownfield sites may be redeveloped, re-using space and saving land in the process
- infrastructural changes that have led to re-imaging or changing the reputation of a city or an area by focusing on a new identity/function
- impacts of development of infrastructure may be negative, e.g. developments in rural–urban fringe areas may cause expansion of suburbanised villages, greater commuting, increasing house prices, closure of local services, decline in bus services, more traffic congestion and other negative environmental consequences
- possible effects of changes in soft infrastructure, such as the local education system, health care provision and law enforcement — crime-prevention strategies and investment in better healthcare may lead to improved quality of life

Conclusion needed: There must be an overall statement of the *extent to which* the experiences of people living in a place have been affected by infrastructural developments.

9 Note that a named case study (the local place) is required.

You must discuss more than one visual source.

Content for your response to this question might include:

- knowledge and understanding of how the selected visual sources can be used to present relevant data for the chosen place
- knowledge and understanding of the local place that has been chosen for study
- visual sources, which could include maps of any data, including historical data, and presented at different scales (SOA; ward; district)
- GIS maps, which could be of census data; Index of Multiple Deprivation; other government statistics, such as crime figures
- overlays of geospatial information, which may be used to assist with interpretation of geographical patterns and to show other features
- photos (including old photos), field sketches, video evidence, artistic sources and media representation (e.g. tourist brochures)

Analysis and evaluation may refer to:

- the usefulness of visual sources in studying a local place, e.g. using new and old geospatial data would help to build up a picture of changes over time
- the relative advantages of visual sources such as GIS in comparison with other visual sources. GIS, for example, is likely to use detailed quantitative data, often from easily accessible 'big data' sets such as the census. This enables detailed, objective geospatial information to be interpreted about a place, usually conveying social, economic and demographic dimensions about a place
- analysis of the ways in which some visual sources are more likely to reflect people's lived experiences, perceptions and perspectives, both past and present, which can help build up a 'sense of place'. These visual sources are less 'objective' and may give clues about how place-meaning is bound up with different identities and experiences
- how visual sources may provide evidence of how the media are attempting to promote place identity
- the fact that some visual evidence may not be comprehensive and reliable — e.g. artists may perceive places differently and video evidence may reflect only one view of place identity; field sketches may be inaccurate

Conclusion needed: There must be an overall statement of relative *usefulness* of two or more visual sources of information for a local place studied.

10 Note that a named case study (the local place or the distant place) is required.

Content for your response to this question might include:

- knowledge and understanding of place identities that may exist for the place as a whole and within this place
- knowledge and understanding of how lived experience may lead to differences in how humans perceive, engage with and form attachments to places
- knowledge and understanding of different groups that experience place in different ways, e.g. young people, older people, disabled people, women, ethnic groups, LGBTQ+
- knowledge and understanding that place identities may be contested or conflicting in the chosen place
- knowledge and understanding of how different place identities may impact on the geography of this place at different scales

- knowledge and understanding of how place identity may not only be the result of lived experience but may also be influenced by the work of external agencies

Analysis and evaluation may refer to:

- the ways that lived experience may affect the attachments, place-meaning and identity within this place, with reference to specific groups within the community
- the ways in which lived experience may lead to different place identities at a range of scales within the chosen place
- lived experience that may have led to 'places of fear' or 'places of exclusion' within a place — this might examine how lived experience may have led to negative perceptions of place
- assessment of how far the lived experiences of different groups have led to different identities of place being expressed, e.g. the lived experience of young teenagers is likely to lead to different meanings and perceptions of that place from those of an elderly group of residents
- assessment of how far the lived experience of different groups within the community is likely to lead to different identities within this place, e.g. some places may be seen as places of 'belonging' for a particular group but be 'places of fear' or exclusion for others
- assessment of how far lived experience or other factors, such as the work of external agencies, may have led to different identities within a place
- assessment of the changing nature of place identities over time and space — e.g. regeneration may lead to the changing geography of place identity

Conclusion needed: There must be an overall evaluation of how far lived experiences of different groups have led to different identities in the chosen place.

6 Contemporary urban environments

1 In 2016 just over half of the global population was urban. The level of urbanisation varies widely across regions of the world. North America, Latin America and the Caribbean are the most urbanised regions, with 80% or more of their populations living in urban settlements. Australia has over 75% of its population living in urban areas; Europe has almost three-quarters of its population living in urban areas. Africa and Asia remain mostly rural, with 40% and 48% of their respective populations living in urban areas. Some countries in Africa, such as Ethiopia, Kenya and Chad, have less than 25% of their populations that are urban. The same can be said for Afghanistan and Nepal in Asia.

2 **Suburbanisation** is the outward growth of urban areas such that they engulf surrounding villages and rural areas. In the UK, during the mid-to-late twentieth century, this was facilitated by the growth of public transport systems and the increased use of the private car.

Counterurbanisation is the migration of people from major urban areas to smaller urban settlements and rural areas. Hence there is a clear break between the areas of new growth and the urban area from which the people have moved.

Statements of difference should be to the fore.

3 **Megacity** growth has been centred on Asia, and especially India and China since 2000 — e.g. Mumbai, Shenzen and Bangkok.

Why have megacities grown?

- rural–urban migration has taken place on a massive scale
- natural population growth within already huge urban areas
- they have more developed formal economies, often with large service-based industries that attract people for work and for the services they offer
- they are stable and have effective governance

World cities have grown largely due to their global influence, often in terms of financial impact, but also in terms of being centres of education, law, advertising, media, sport, and cultural and political strength. They also have high levels of connectedness, both physical (air, rail) and electronic. Examples include New York, London, Paris and Hong Kong.

Your answer should be illustrated with use of examples.

4 Latin American cities, where much of the study of developing world cities originated, are built up around a central core (which usually acted as an administrative zone and later commercial area), from which there may be a commercial spine and/or a spine of higher-quality housing. This is surrounded by concentric zones of housing that decrease in quality with distance from the core, with squatter settlements on the periphery. Later, some cities developed a zone of industrial activities around the core due to the lack of infrastructure further away. This resulted in a mix of business, industry and homes for the wealthy near the central area.

You might also refer to the Ford model of a developing world city: a central city centre, spines of elite housing stretching to an out-of-town mall complex and an industrial development spine (often in opposite directions), some external industrial areas, but with largely decreasing-quality housing as you move away from the central zone of the city.

As a comparison, description of models of the urban structure of developed world cities may include any of the Burgess (concentric circle), Hoyt (sector), or Harris and Ullman (multiple nuclei) models.

Your answer is likely to be totally theoretical — although any use of appropriate examples should be credited. Your answer should concentrate on points of difference, with the emphasis being on what makes the structure of the developing world city different.

5 Content for your response to this question might include:

- definition of counterurbanisation and explanation of the factors that cause it
- description of the extent of social and demographic changes resulting from counterurbanisation, e.g.:
  - rising demand for second homes and earlier retirement into rural areas may result in the out-migration of young village-born adults seeking education and employment opportunities elsewhere
  - this may also lead to the in-migration of young to middle-aged couples or families with children, or increased numbers of older residents and second-home owners

Analysis and evaluation may refer to the following:

- analysis of social outcomes, which may include tensions between the newcomers and local people
- conflict caused by closure of local services, reduction in bus services to many rural communities, and closures of schools, churches and post offices

- newcomers have the wealth and mobility to continue to use the urban services some distance away
- the effects of an influx of more affluent newcomers, which may lead to increased pressure on agricultural land for building and outward expansion of suburbanised villages. This in turn could result in increased land values and higher house prices; locals may be unable to compete for housing, causing further tension
- analysis of economic and social change in urban areas from which people move, e.g.: loss of population, especially higher-income groups, could lead to deterioration in urban environment; the area may decline as housing stock falls into disrepair, with a resulting doughnut effect; economic activities may follow, as loss may lead to the closure of schools and healthcare provision
- positive impacts could also be analysed, e.g. reduction of housing pressure, reduced congestion, changes in cultural/ethnic mix as new groups arrive
- extent of social change in both locations — which may depend on rate of expansion and development, changes to age structures and income groups, and degree of disruption to existing communities
- the extent of economic change, e.g. improvements in broadband technology allow more freedom of location for employment, so local services may be supported; newer residents may be professionals or retired people who have higher disposable income
- possible benefits to companies who have the opportunity to locate their business in edge-of-town shopping areas and business parks

Conclusion needed: There must be an overall assessment of the *extent to which* counterurbanisation has led to social and economic change.

6 This is quite an esoteric area of geography, linking urban geography with the study of 'place' — concepts such as identity, belonging and 'insider' versus 'outsider' perspectives.

Many people who live outside slums/favelas/shanty towns have a preconceived view of the people, in addition to the conditions, of these areas — which in effect perpetuates their existence. Many 'outsiders' see the periferia-type places as being the outcome of the values and attitudes of the people who live within them, and they are often voiced in disparaging terms, e.g. they are awarded nicknames such as '*favelado*' in Brazil.

Investment and opportunities are likely to continue to be unequally available, with the outcome that inequality will be maintained. Indeed, some sociologists and economists see this as the norm. For some local authorities, slums can represent a kind of built environment that has featured longstanding prejudices and historical inequalities — a process called favelisation — and they believe they cannot be improved significantly (or that may be the excuse given for a lack of investment).

Furthermore, the perception of individuals and communities located within these poor places ('insiders') is also assumed to be one of having low aspirations and little ambition to improve. The mission of several NGOs that work in these areas, however, is often to raise individual and community ambition as well as provide opportunity to 'escape' the favela. This is not helped when responses by local government are to maintain a social system that favours an exclusive, elite vision of urban growth in developing world cities, such as the favela wall being constructed in Rio de Janeiro.

Fighting the perceptions of both 'outsiders' and 'insiders', therefore, is a challenging task.

Conclusion needed: There must be an overall assessment of the role of perception in perpetuating inequality in developing world cities.

7 The urban heat island effect (UHIE) refers to the generally warmer (by 3–5°C) urban temperatures compared with those of surrounding, non-urban areas. The UHIE is the product of a variety of factors. These include:

- anthropogenic sources of heat
- multiple reflections of incoming solar radiation from tall buildings, especially those with high levels of glass
- urban surfaces tend to have a lower albedo, which enables them to absorb more of the incoming solar radiation. This is combined with the higher heat capacity of urban surfaces, which allows them to absorb the heat and store it. This heat is then released slowly when the air begins to cool at night
- the efficient drainage of the urban surface removes surface water quickly. There is less capacity for evaporation, with its associated cooling effect, to take place
- there is less vegetation, which would cool the air by transpiration
- above many cities there is a dome of particulate and NO_2 pollution. This allows the short-wave radiation from the Sun into the urban atmosphere. It then absorbs and reflects the outgoing longer-wave radiation, preventing its escape

- often increased cloud over the urban area also reflects outgoing radiation back to the surface
- the roughness of urban surfaces tends to reduce wind speed and hence its ability to flush out the warm air

The UHIE develops best under certain meteorological conditions. The contrast between urban and rural areas is greatest under calm, high-pressure conditions, particularly with a temperature inversion in the boundary layer. Heat islands are often well developed in winter when there is a bigger impact from city heating systems.

8 Note that a named case study is required, and should be used to support the points made.

Points could include:

- a relatively old scheme — historically rivers were often narrowed or straightened to accommodate industrial or residential development; the land on either side that is built up then has poor drainage and struggles to cope with overtopping rivers
- the impacts of river widening or restoration of wetland environments — e.g. reducing the flood risk by increasing river-water storage and slowing down surface runoff
- a 'softer' (often more recent) scheme — working with nature and building in natural mechanisms
- analysis of possible social impacts on the local area, e.g. creating a double meander and wider river channels, protecting local residents from flooding
- there may be encouragement for new businesses (or sporting venues) to locate in the area, but they must incorporate environmental and sustainable aims in their design
- evaluation of the cost-effectiveness of a scheme — details of costings would be needed here

Conclusion needed: There must be an overall assessment of the *extent to which* water movement through an urban area has been affected.

9 There are a number of ways in which governments (local and national) have tried to reduce atmospheric pollution in cities:

- Clean Air Acts: legislation to reduce the amount of smoke entering the atmosphere

- vehicle control in inner urban areas: for example, many British towns and cities have pedestrianised their CBDs. In London, attempts to control vehicle numbers have been made by the Congestion Charge. Some cities overseas (Mexico, Paris) have passed laws restricting vehicles coming into the city, such as alternate-day driving
- more public transport: e.g. Manchester's tram system (Metrolink), the development of bus-only lanes into city centres, the growth of park-and-ride schemes in many British cities, and the encouragement of car-sharing schemes
- zoning of industry: planners aim to place industry downwind in a city, and planning legislation has forced companies to build higher factory chimneys in an attempt to emit pollutants above the inversion layer
- vehicle emissions legislation: motor vehicle manufacturers have been forced to develop better fuel-burning engines and introduce catalytic converters that remove some of the particulates from exhaust fumes
- development of electric and hybrid vehicles: e.g. many of London's buses, the provision of charging points in supermarkets
- London's Low Emission Zone (LEZ): the most polluting vehicles are required to pay a daily charge for being within that area

10 You are expected to refer to more than one urban area — which may be in a developed country or a developing country.

Content for your response to this question might include:

- definition of the term 'sustainability' — recognition that it is a complex concept
- knowledge and understanding of sustainability issues in urban areas, such as waste disposal, transport management, atmospheric and water pollution
- knowledge and understanding of the solutions/management strategies adopted by identified areas
- a comparison between contrasting urban areas in countries along the development continuum and/or within the same level of economic development

Analysis and evaluation may refer to:

- detailed critical understanding of the sustainability issues identified and the factors that may have contributed to them

- detailed critical understanding of the responses to the above issues
- detailed critical understanding of the management, where applicable, of the sustainability issues identified
- a recognition of the importance of values and attitudes, and of the role of decision makers/stakeholders (players) at a variety of levels
- judgements as to whether sustainability can ever be achieved

Your answer is likely to score better if you provide supporting material from one or more case studies. Specific detail is always better than just general points.

Conclusion needed: There must be an overall statement of the *extent to which* urban areas can be sustainable.