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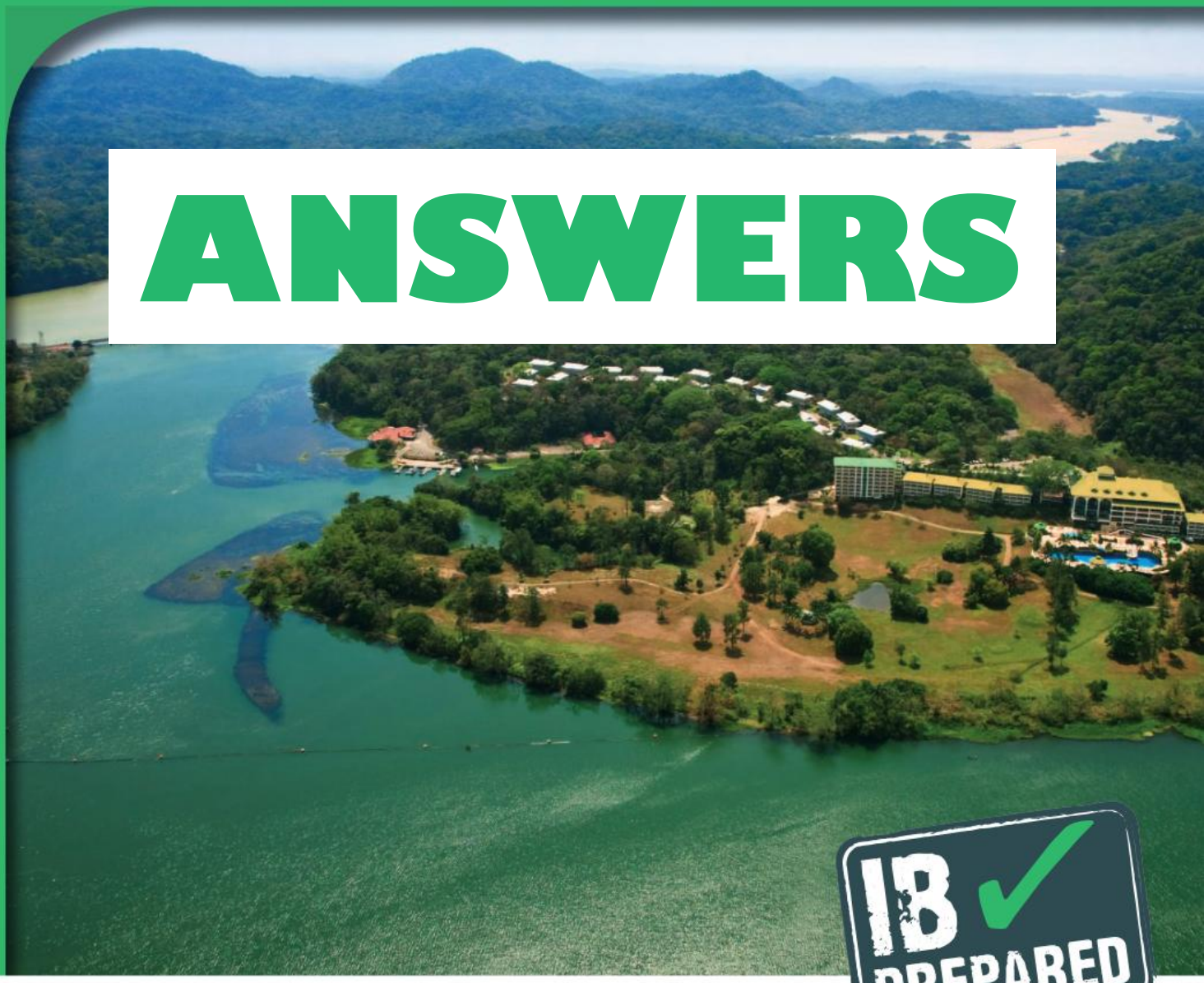
GEOGRAPHY



ANSWERS

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IB DIPLOMA PROGRAMME

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IB Prepared Geography

Answers to *test yourself* questions

Here are the answers to the *test yourself* questions from *IB Prepared Geography*.

For direct access, click on the name of the chapter.

Option A: Freshwater

A.1 An open system allows the transfer or movement of water across the boundary of one drainage basin to another. A closed system will not allow this. The Earth's hydrological system is an example of a closed system.

A.2 There are inputs (precipitation) and there are outputs (evaporation/evapotranspiration and discharge). The transfers that exist in the system are flows, such as overland flow (surface run-off) or flows underground (throughflow and groundwater flow). Finally, there are stores that will hold moisture which could be on the surface (leaf storage, ponds, lakes) or underground (aquifers, soil moisture).

A.3 *Rock type:* A rock type that is more permeable or more porous, such as limestone, will allow a greater amount of water to infiltrate the ground, thus there will be more instances of throughflow and groundwater flow. Conversely, a rock type that is more impermeable, such as granite, will prevent infiltration and water will remain on the surface and become overland flow. Since overland flow is a faster type of flow or transfer than throughflow or groundwater flow, the type of rock will influence the speed of movement as well as the type of flow.

Vegetation: Areas that have dense vegetation can prevent the flow of water since precipitation will be intercepted and stored in leaves and branches. If the leaf storage capacity is reached, there may be stem flow so that water may eventually reach the ground and then either infiltrate the surface or become overland flow. Areas that have suffered deforestation will not have any protection for the soil, and this could result in erosion from future precipitation and an increase in overland flow since the ground may get saturated quickly.

A.4 The River Seine flows from south-east to north-west, and the distance from its source to its mouth is approximately 425 km. The basin shape narrows towards the mouth of the Seine. Twelve tributaries join the Seine along its course.

A.5 Theoretically, the wider and deeper the channel that holds the river, the greater the discharge. This is because there should be less friction and greater efficiency, meaning that the hydraulic radius will be larger. In other words, the river is able to flow without facing obstructions that could slow down the velocity. In the lower course of a river, the river's cross-sectional area will be larger and thus will have a higher discharge than in the middle and upper courses of a river, where friction will be greater and will reduce the velocity of the river and subsequently reduce its discharge.

A.6 In general, the higher the discharge, the greater the ability of a river to transport material as part of the suspended load. Larger particles can be transported due to the faster movement of a large volume of water. The Hjulström curve demonstrates this, although there is an anomaly: clay requires a greater discharge than larger particles since clay particles tend to stick together and the larger mass requires a greater discharge. Certain particle sizes may never become part of the suspended load due to their density and will instead be part of the load and be transported via a process such as traction.

A.7 The word 'temporal' relates to time and seasonality. It can be a factor in influencing the discharge of a river. A river's regime will show how there are variations throughout the year. A season such as spring may bring rainfall to a drainage basin and subsequently increase the level of discharge in a river and its ability to transport eroded material. In winter, the ground within a drainage basin may be frozen and there may also be a lack of rainfall, so there is a large amount of water stored in the cryosphere rather than reaching the river to enable the increased possibility for the transportation of material. Changes over a shorter time period, such as a period of low pressure creating heavy rainfall, will increase river levels, and again the greater volume will mean an increase in the suspended load.

A.8 **(a)** Waterfall; gorge.

(b) A waterfall is formed due to water flowing over two different types of rock, one which is more easily eroded than the other. As the less-resistant rock is eroded, it will eventually undercut the more resistant rock, which will then leave the harder rock exposed as there will not be a layer of rock beneath it to provide support. Eventually the more resistant rock will collapse into a plunge pool below.

A.9 Physical factors that would increase the discharge include an intense period of rainfall, which would not only fall on the river, but also on nearby land where the infiltration capacity of the ground is soon reached, thus creating overland flow. Subsequently the lag time (the difference between the peak discharge and the peak rainfall on a hydrograph) would decrease and the discharge would increase.

Seasonal occurrences, such as a prolonged rain period of the year or the months in which nearby snow melts, would increase the amount of discharge shown on a hydrograph.

Basins with more impermeable rock types are more liable to overland flow and shorter lag times compared to basins with more permeable rock types, which will allow through flow after infiltration has taken place. This would make the rising limb much steeper on a hydrograph.

A.10 If a river has been monitored over time, then there will be historical data in the form of a hydrograph that shows the amount of discharge each year. By analysing past data, it is possible to make predictions for the interval time between flooding events, for example every 25 years. In addition, by examining the amount of rainfall in past flooding events and the effect upon a river's discharge, it is possible to predict the lag time if the same amount of rainfall falls again. Furthermore, by analysing the time it takes for discharge to decrease after a given period of rainfall, it is possible to predict how long it will take for flooding to subside. People can be evacuated once the lag time has been accurately calculated, if there is a particular rainfall amount. Using all this data, authorities are able to consider which flood defences are the most effective in order to increase the lag time and reduce the possibility of flood.

A.11 The country has a number of rivers that require management and some of these originate in other countries such as India, Afghanistan and China. The actions of the governments in these countries, such as the building of dams or deforestation, will affect the amount of water flowing down rivers in Pakistan and may increase or reduce the need for flood mitigation.

A.12 The strategies were not successful since there was significant economic damage and loss of life from flooding in 2014. Early warnings were not received or heeded by people in heavily populated areas, and they did not evacuate. Poorly maintained embankments were either naturally breached or were breached by the authorities, which meant that villages were flooded.

A.13 Physical water scarcity is where water consumption exceeds 60% of the usable supply; it relates water availability to water demand and implies that arid areas are not necessarily water scarce. Economic water scarcity is where water is available locally but is not accessible for human, institutional or financial capital reasons.

A.14 Most of the countries suffering from economic water scarcity are in sub-Saharan Africa. South and South-East Asian countries and a small number of countries in the west of South America are also affected, such as Bolivia and Peru. In North America, Europe and Oceania there are no areas that are affected by economic water scarcity.

A.15 Arable and pastoral farming can cause significant damage to freshwater. Animals can contribute pollutants via the manure that they produce which leaches into surface and groundwater. For example, pig effluent from factory farms in North Carolina (USA) has contaminated the freshwater. The commercial production of crops often involves fertilizer and pesticides to increase crop growth and provide protection from pests. This adds nitrogen and phosphates to the soil and these chemicals are then leached into freshwater. Another term for this would be agrochemical run-off. The chemicals in freshwater can then cause eutrophication. This occurs when algae blooms are produced on the surface of the water, which then starves the river or lake of oxygen and destroys the ecosystem.

Salinization occurs when irrigation causes an increase in the salt content of water. All water contains dissolved salts and once crops have utilized irrigated water, salt content is left behind. This salt is then be leached into freshwater sources via overland and through flow.

A.16 A government has a commitment to ensure that basic services are provided for its citizens and the provision of water is included in this. In addition, economic development will require water for industrial processes as well as for food and energy production. The decline in water in one country downstream due to the development of a country upstream will create friction between the two countries as they try and satisfy basic needs, while attempting to further the development of their countries.

A.17 Dams are often used as a way of controlling a river and its flow. In addition to preventing flooding, which can have significant economic, social and environmental impacts, the revenue gained from the sale of electricity or water can increase a country's GDP in the long-term as well as the tax revenue from the employment of workers in the construction projects. The construction of large dams can take decades and the creation of indirect jobs is also beneficial. There are always costs, but displacement of local communities can be mitigated by compensation and, compared with the development revenue for a country, the benefits can be viewed as more important than the costs.

A.18 Integrated drainage basin management; a drainage basin that is managed in such a way that there are economic, social and environmental benefits to those that live and work in the location.

A.19 The Mekong Integrated Water Resources Project for the Lower Mekong Basin was introduced and implemented between 2016 and 2020. This project builds on the 1995 Mekong Agreement signed by Cambodia, Laos, Thailand and Vietnam. Some of the initiatives are:

- the development of hydropower along tributaries within the Basin, particularly in Laos and Cambodia;
- the development of hydropower along the actual Mekong river;
- the expansion of irrigated agriculture.

A.20 When the course of a river runs through a series of countries, the decisions made by one country can have an impact on another country, especially if it is downstream. Part of the IDBM proposes the building of a series of dams in Laos, and the Cambodian government is worried, while Vietnam is worried about Cambodia's proposed dams.

Benefits:

- The production of energy that reduces greenhouse gas emissions from traditional forms of energy production.
- A water diversion project in Thailand will prevent drought and boost the income of farmers who currently earn 50% less than the average salary in Thailand.

Problems:

- Irrigation projects will add more salt to the Mekong River and increase salinity in the Mekong Delta, an area that is the main producer of food for Vietnam.
- Some 4% of the Lower Basin's wetlands have been lost to a reduction in the flow.
- China is planning a series of dams upstream of the Lower Basin which will significantly impact the capacity of some of the dams on the Mekong itself.
- Fisheries will be impacted by the building of dams upstream since the migratory patterns of fish will be disrupted.

A.21 Wetlands are areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt.

A.22 Wetlands have economic, environmental and social benefits. Not only do they provide a source of food and water, but wetlands can also maintain water quality by acting as a natural filter. In addition, tourism revenue can be generated as people want to explore these areas in order to view bird life and other wildlife. The sale of timber from wetlands can also create economic benefits for a place. Wetlands can provide a buffer for a flood event since the area can absorb excess flood water whilst protecting coastal areas from the impact of heavy seas. Finally, wetlands can be a source of energy via the extraction of peat that can be burned to generate heat.

Option B: Oceans and coastal margins

B.1 **(a)** Gulf Stream/North Atlantic Drift

(b) Labrador Current

B.2 The effect of ocean currents on temperatures depends on whether they are cold or warm. Warm currents from equatorial regions raise the temperature of polar areas (with help from prevailing westerly winds). However, the effect is only noticeable in winter. For example, the North Atlantic Drift raises the winter temperatures of north-west Europe. Some areas are more than 24°C warmer than the average for their line of latitude. By contrast, other areas are made colder by ocean currents. Cold currents such as the Labrador Current off the north-east coast of North America may reduce summer temperature, but only if the wind blows from the sea to the land.

B.3 During La Niña events, cold water pushes upwards off the coast of South America, displacing warm towards Australia. Warm surface water causes evaporation over the western Pacific and there is rainfall over Australia/Indonesia. In contrast, there is descending air over South America and dry conditions prevail. During an El Niño year, the trade winds decline and warm water flows eastwards in the Pacific. There is increased convection over the Pacific, and rain occurs over the eastern Pacific and South America.

B.4 Hurricanes are intense hazards that bring heavy rainfall, strong winds, and high waves and cause other hazards such as flooding and mudslides. Hurricanes are also characterized by enormous quantities of water. This is due to their origin over moist tropical seas. High-intensity rainfall, as well as large totals (up to 500 mm in 24 hours), invariably cause flooding.

B.5 Haiti experienced a large number of deaths on account of its poor-quality housing, overcrowding, steep deforested slopes and poor emergency services/water infrastructure.

B.6 The major reservoirs of carbon dioxide are fossil fuels ($10{,}000 \times 10^{12}$ kg of carbon), the atmosphere (750×10^{12} kg of carbon) and the oceans ($38{,}000 \times 10^{12}$ kg of carbon). Oceans play a key role in the carbon cycle. Photosynthesis by plankton generates organic compounds of carbon dioxide. Some of this material passes through the food chain and sinks to the ocean floor where it decomposes into sediments. Eventually it is destroyed at subduction zones where ocean crusts are subducted beneath the continental plates. Biological processes, such as photosynthesis, turn carbon dioxide into organic material. Over time, organic carbon sinks to the ocean's depths. The upper ocean therefore has a lower concentration of carbon than the deep ocean. If carbon on the ocean floor was lifted to the surface (as in a thermohaline circulation) the ocean could become a source of CO_2 rather than a sink.

B.7 **(a)** The cause of ocean acidification is believed to be anthropogenic (man-made) sources, such as carbon emissions from industrial plants, power stations, cars and planes.

(b) More acidic oceans are killing coral reefs and shellfish beds and threaten fish stocks. Increasing ocean acidification will reduce calcification in corals and other calcifying organisms, resulting in slower growth and weaker skeletons. Scientists estimate that oceans absorb around a million tonnes of carbon dioxide every hour. As a result, they are now 30% more acidic than they were in the 1900s. This increased acidity adversely affects calcium carbonate, which forms the shells and skeletons of many sea creatures, and also disrupts reproductive activity.

B.8 Constructive waves have a low height, long wavelength and a stronger swash compared with the backwash (hence they build up beaches). In contrast, destructive waves have a short wavelength, high height and a stronger backwash compared with their swash. Thus they erode beaches.

B.9 The coastal sediment system, or littoral cell system, is a simplified model that examines coastal processes and patterns in a given area. It operates at a variety of scales, from a single bay to a whole region. Each littoral cell is a self-contained cell, in which inputs and outputs are balanced.

B.10 The tidal range has important influences on coastal processes.

- It controls the vertical range of erosion and deposition.
- Weathering and biological activity is affected by the time between tides.
- Velocity is influenced by the tidal range and has an important scouring effect.

B.11 In wave refraction, the waves slow down and change shape as they attempt to break parallel to the shore. Wave refraction will concentrate wave energy and therefore erosional activity on the headlands, while wave energy will be dispersed in the bays; hence deposition will tend to occur in the bays.

B.12 A stack is a tall, standing pillar of rock that has been eroded by the sea. A stump is a relatively small pillar of rock that is formed by the erosion of a stack.

B.13 Due to coastal erosion, a cliff begins to retreat and is replaced by a lengthening wave-cut platform. As a result of cliff retreat, the platform becomes gradually longer. With continued erosion and retreat of the cliff, the wave-cut platform gets longer—it may reach a length of up to about 500 m.

B.14 Spits are formed by longshore drift along an irregular coastline. Longshore drift carries sediment downdrift. In some cases, a change in the coastline occurs. Longshore drift is unable to respond immediately to the change and so continues to carry the sediment out and away from the shoreline. As a result of wave refraction, spits often become curved. Cross-currents or occasional storm waves may assist this hooked formation.

B.15 Wave refraction concentrates erosion on the flanks of a headland. Weaknesses such as joints or cracks in the rock are exploited, forming caves. Caves enlarge and are eroded back into the headland until eventually the caves from each side meet and an arch is formed.

B.16 **(a)** A fjord is a glacially eroded U-shaped valley, which is drowned as a result of eustatic sea level rise.

(b) A relict cliff is a cliff that has been formed by coastal erosion, and has risen either due to isostatic uplift (the land rising) or a fall in sea level, or a combination of the two.

B.17 Sand dunes form where there is a reliable supply of sand, strong onshore winds, a large tidal range and vegetation to trap the sand. Vegetation causes the wind velocity to drop, especially in the lowest few centimetres above the ground, and the reduction in velocity reduces energy and increases the deposition of sand. Vegetation is also required to stabilize dunes.

B.18 Home owners or farmers may want their properties or land to be protected, whereas local councils may feel that they are wasting money on land that will eventually be eroded. Some conservationists may want a unique habitat to be protected whereas government agencies may want to put up coastal protection schemes regardless of the disruption to natural processes.

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B.20 The distribution of coral is controlled by seven main factors:

- Temperature—no reefs develop where the mean annual temperature is below 20°C. Optimal conditions for growth are between 23°C and 25°C.
- Depth of water—most reefs grow in depths of water less than 25 m, and so are generally found on the margins of continents and islands.
- Light—corals prefer shallow water because they need light for the zooxanthellae, which supply the coral with as much as 98% of its food requirements.
- Salinity—corals are marine organisms and are intolerant of water with salinity levels below 32 psu, but can tolerate high salinity levels (>42 psu) as found in the Red Sea or the Persian Gulf.
- Sediment—sediment has a negative effect of coral. It clogs up feeding structures and cleansing systems, and sediment-rich water reduces the light available for photosynthesis.
- Wave action—coral reefs generally prefer strong wave action, which ensures oxygenated water and a stronger cleansing action. This helps remove any trapped sediment and also supplies microscopic plankton to the coral. However, in extreme conditions, such as the South Asian tsunami, the waves may be too destructive for the coral to survive.
- Exposure to the air—corals die if they are exposed to the air for too long. They are therefore mostly found below the low tide mark.

B.21 The pressures on coral include climate change, which causes bleaching; poor land management practices, which damage the reefs with sediments, nutrients and other pollutants; overfishing and destructive fishing practices; and coastal development. Climate change is an especially large threat; increased water temperatures have already been blamed for the single most destructive event for corals: the 1998 bleaching.

Global climate change will cause irreparable damage to coral reefs in our lifetime for several reasons:

- Increasing sea surface temperatures will cause more coral bleaching and mortality during summer. The abundance of many coral species will be reduced and some species may become extinct.
- Ocean temperatures will increase beyond the current maximum of natural variability, making bleaching a frequent, or eventually an annual, event.
- Increasing ocean acidification will reduce calcification in corals and other calcifying organisms, resulting in slower growth, weaker skeletons and eventual dissolution.

B.22 The ecological services provided by mangrove swamps include products such as fuelwood, charcoal, timber, thatching materials, dyes, poisons and food such as shellfish and crustaceans. Many fish species, both commercially farmed and farmed for subsistence, use mangrove swamps and sea-grass beds as nurseries. In addition, mangrove trees provide protection from tropical storms and act as sediment traps.

B.23 Territorial waters are the waters (sea/ocean) over which a country has full sovereignty rights. In contrast, the economic exclusive zone is the sub-surface area over which a country has exclusive rights for the exploitation of marine resources, eg fish, energy resources and metals.

B.24 Many countries may wish to exploit the resources that are found in the EEZ of another country. For example, the UK was involved in a number of "cod wars" with Iceland, over access to fish stocks. As a result of these conflicts, Iceland extended its EEZ from 3 nautical miles to 200 nautical miles—which is now the standard size of an EEZ as recommended by the UN. Many countries may claim rights over an EEZ due to contested rights over islands, eg Australia has claimed rights over some of the seas off Papua New Guinea.

B.25 Abiotic resources are those that are non-living.

B.26 Abiotic resources in the Arctic include oil and natural gas.

B.27 The Arctic is believed to contain up to 90 billion barrels of undiscovered oil (that is 13% of the world's undiscovered oil), 30% of the world's undiscovered natural gas and 20% of its undiscovered natural gas liquids.

B.28 There is a risk of oil pollution and gas flaring. Oil pollution breaks down very slowly in cold environments so will persist for a very long time. In addition, infrastructure developments will destroy habitats and may pollute water and soil. The transport of materials into and out of cold environments could lead to increased pollution from shipping.

B.29 Some locations, such as the East China Sea, are relatively small (globally) but experience a huge amount of shipping/trade. Therefore it is likely that with more container ships there will be more discharge of pollution into the ocean. Also, there is much runoff from waste from mainland China. Similarly, the North Sea is very small by international standards, and it receives waste material from much of industrialized Europe, including the UK, the Netherlands and Germany.

B.30 Small seas, seas with limited currents and/or enclosed seas have much more potential to be polluted, eg the Mediterranean Sea. Seas that are more distant from land may have less pollution. Shallow seas probably have more economic and commercial activity in them than very deep oceans. Seas with resources (such as oil and gas), eg North Sea, may have more economic activity and more potential for pollution. Tropical seas may have more cruise liners than colder seas, and more waste disposal as a result.

B.31 The South China Sea has important reserves of oil and gas; it is also an important trade route. It is also an important source of fish.

Option C: Extreme environments

C.1 **(a)** Ice sheets are associated with high latitudes, eg Antarctica is south of the Antarctic Circle (66.5°S) and Greenland is largely north of the Arctic Circle (66.5°N).

(b) The world's great deserts are largely found in the tropics/sub-tropics (20-30°N and S), eg the Sahara Desert and the Kalahari Desert.

C.2 Periglacial areas have very limited hours of sunlight in winter, making many activities more difficult/expensive to operate in absence of natural light.

C.3 Both have low rates of precipitation. Both may have mountains and can be quite remote/inaccessible.

C.4 People may wear loose clothing to allow air to circulate. Light-coloured clothing reflects solar radiation and long clothing protects against the sun during the day. Headdresses provide protection from the sun and can be wrapped around the face to protect against sand storms caused by high wind speeds.

C.5 Natural cycles, such as Milankovitch cycles, affect the amount of solar radiation reaching the Earth's surface. When the Earth's orbit around the sun is more circular (about every 95,000 years) it does not receive as much insolation as it does when the orbit is more elliptical. When the Earth's tilt is greater, there is a more variable receipt of insolation—favouring warm interglacials. The Earth "wobbles" on a 21,000 year cycle. At present, the earth reaches its furthest point from the sun in the southern hemisphere winter and therefore winters are slightly colder than northern hemisphere winters, and southern hemisphere summers are slightly warmer than northern hemisphere summers. The more stable conditions in the northern hemisphere lead to the warmer interglacials.

C.6 As temperatures increase and the ice melts, if a white-reflective surface is replaced by a dark, non-reflective surface, increased insolation is absorbed by the ground, leading to an increase in temperature which further reinforces melting and the decline of ice.

C.7 Human activity is presently causing a rise in average annual temperatures, leading to the melting and retreat of glaciers—especially small, mountain glaciers.

C.8 Lateral moraine is formed from the accumulation of material at the side of a glacier, whereas medial moraine is formed when two lateral moraines join.

C.9 Erratics are rocks of "foreign geology", ie they are deposited in an area where they did not originate. If their origin can be located, it is then possible to interpret the direction of glacier movement, as they have moved from their origin to their present destination.

C.10 **(a)** Permafrost is permanently frozen subsoil.

(b) Thermokarst refers to an irregular surface of shallow depressions and pits formed from extensive thawing of ground ice.

C.11 **(a)** Patterned ground refers to the regular stone circles and polygons on flatter ground, and stone stripes on steeper slopes, found in areas where there is limited precipitation and limited ice. They can be several metres wide. Thermal contraction leads to the splitting of the ground, which may become filled with sand and gravel. A mixture of freeze-thaw, intense frost heave and solifluction leads to the development of patterned ground.

(b) Frost heave is a process in which water that freezes lifts soil particles (peds) and stones within the ground upwards towards the surface. Over time, materials may be lifted to the surface.

C.12 High diurnal temperatures allow exfoliation (disintegration) to occur, while high evaporation rates may allow some forms of chemical weathering to take place. Irregular, heavy rains produce flash floods which can cause erosion, while sustained strong winds lead to wind erosion.

C.13 The thawing of permafrost can lead to subsidence. Developments such as mineral extraction and associated infrastructure construction expose permafrost to higher temperatures and increase the risk of melting and resulting subsidence. Services need to be provided in insulated pipes. Roads and buildings need to be constructed on mounds of gravel to reduce the possibility of rising and falling of land with the freezing and melting of ice.

C.14 Large areas are being damaged and polluted as mining companies prepare to develop minerals including uranium, iron ore, nickel, coal, zinc and phosphorus. Existing mines are contaminating the feeding grounds of reindeer, with heavy metals such as antimony, copper, cobalt, nickel and chromium. For example, there is a planned mining project in Norway which would result in millions of tonnes of waste from copper mines being dumped into the Repparfjord.

C.15 For example, coal, copper, gold, iron, lead, lithium, manganese, molybdenum, natural gas, nitrogen, petroleum, silver and zinc.

C.16 Copper accounts for over 60% of Chile's export revenue and copper production in Chile accounts for about 50% of the total production of the top five producers of copper globally.

C.17 Tourism has grown as more people have a larger disposable income and can afford to travel to the UAE from places where it was previously less financially feasible. The standard of facilities in the UAE is high and many new facilities are being built. The government is keen to reduce its dependence on fossil fuels (although such fuels are needed to transport the tourists and in the construction of new infrastructure). It is also a high earner for the companies involved in tourism.

C.18 Problems could include over-investment, falling demand (due to recession or the desire to explore new locations), pollution of the environment and cultural antagonism.

C.19 Reasons include: the various attractions of its wilderness areas eg scenery and wildlife; improved accessibility; improved infrastructure; increased personal affluence and leisure time; the desire for new experiences.

C.20 The construction of ski pistes for ski resorts requires deforestation, which removes the natural protection against avalanches and degrades the natural landscape. Additionally, new resort construction involves bulldozing, blasting and reshaping of slopes. This increases slope instability and, together with deforestation, leads to a higher incidence of avalanches.

C.21 Impacts of desertification include: reduced crop yields; reduced biomass productivity and water availability; the advance of sand dunes and desert-like vegetation onto productive land and settlements; increased soil erosion/degradation. It can lead to a vicious circle of poverty, falling food production, hunger and malnutrition. It leads to falling incomes for farmers and reduced revenues for national governments. It may lead to increased rural-to-urban migration, and increasing pressures in urban slums.

C.22 Wind erosion can be reduced by the construction of wind breaks. Runoff can be captured by building small earthen dams. Fencing can be used to control livestock. Trees can be planted to help bind the soil, return nutrients to the soil and act as wind breaks. Plant, livestock and household waste can be composted to add humus to the soil.

C.23 Stakeholders in favour of mining include the Australian government, the Indian company Adani, the Indian government, mining companies and potential workers at the mines. Those against include the Aboriginal community, environmentalists, farmers and major banks.

C.24 The advantages of mining in the area include the number of jobs it creates, the revenue it brings to Australia, the energy that it may bring to India, and profit for Adani. However, Aboriginal communities have lost their traditional land, the mine could lead to global warming, it could destroy coral on the Great Barrier Reef, water resources may disappear thus threatening the livelihoods of farmers. The reef will need to be cut to let supertankers through and there is a risk of collisions, spills and excessive oil dust ruining the coral.

C.25 Advantages of solar energy include: it is a renewable resource, and it does not generate noise or direct pollution during electricity generation. Some disadvantages are that it is costly to set up, and its power cannot be harnessed by night or during intense storms.

C.26 An example of positive feedback in a warming Arctic is the increased vegetation cover (shrubification), leading to a lower albedo, causing more warming, increasing the potential for more vegetation. An example of negative feedback is the reduced snow cover, leading to more vegetation growth and carbon uptake, potentially leading to cooling, which leads to longer periods of snow cover.

C.27 A tipping point occurs when a natural system undergoes sudden or large-scale change, which leads to irreversible change. For example, the increased temperature of the Arctic has led to greater thinning of Arctic sea ice, which allows waves to break up the sea ice, which leads to greater thinning, less reflectivity, warmer temperatures and increased melting and break-up of Arctic sea ice. These changes are irreversible.

Option D: Geophysical hazards

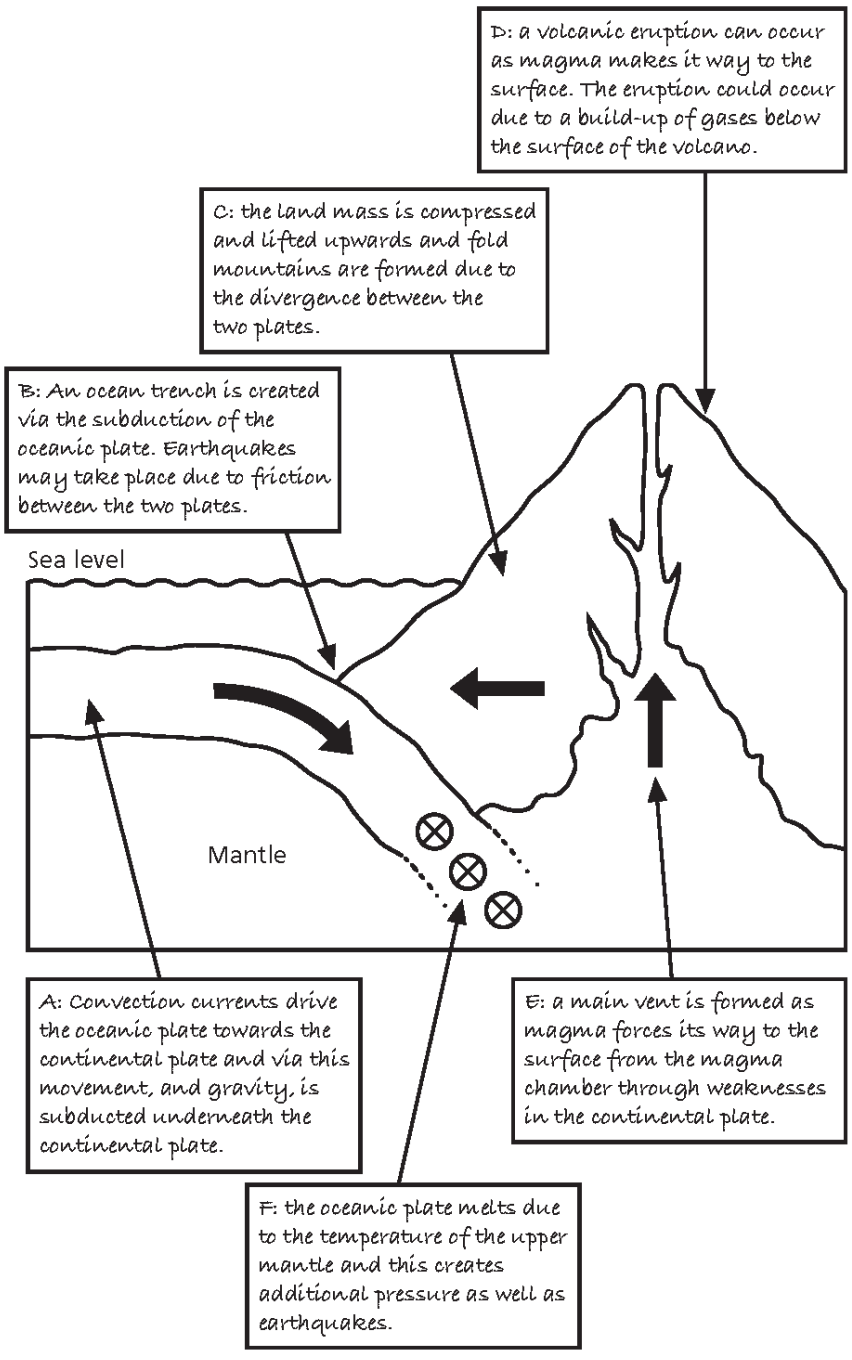
D.1

(a) Cinder cone, composite and shield are the main types of volcanoes and are mentioned in the syllabus. However, there are other types such as a lava dome.

(b) A composite volcano will emit lava alongside ash and tephra. The lava that flows from this type of volcano is very viscous, and because of this, it cools and hardens before it is able to spread too far thus creating the steep sides for this type of volcano. This type of lava is classified as acidic.

A shield volcano will eject basaltic lava which is less viscous and is able to travel a longer distance than lava from a composite volcano. It flows from a central vent and each eruption will add material and increase the size of the volcano.

D.2



D.3 Divergent plate margins will normally have distinctive landforms (such as ridges) at either side of a rift valley. These are formed as the sea floor spreads and there is tension in the Earth's crust as the crust diverges. A central rift will subside due to this tension and this will create fault lines in the crust. Shield volcanoes may form along the rift system where there are fissures and fracturing. The Mid-Atlantic Ridge would be a good example for this type of landform found at a divergent plate boundary.

Divergence can also take place on land, and rift valleys are formed, such as the formation of the East African Rift Valley. Again, the earth's crust is stretched and weakened. The land subsides in the centre of the rift and wide valleys are created with volcanoes formed at the edges of the rift, such as Mount Kenya, an extinct composite volcano. This type of valley is formed by tectonics processes and not via fluvial or glacial processes, although water can accumulate in valleys, forming rift lakes. The Dead Sea is an example of a rift lake.

D.4 Similarities (compare): Both flows and slides can be classified as fast types of mass movement.

Differences (contrast): Flows tend to have a drier composition whereas slides have greater moisture content.

It should also be explained that some flows/slides are faster than others, and moisture content will vary between flows and slides also.

D.5 Rapid mass movements will cause problems since the speed of onset and the speed at which the material is travelling is much quicker than slower mass movement. These two factors mean that it is difficult to predict when the movement will take place. When it does occur, the velocity will have more momentum and power to destroy what is in its path. Avalanches and mudslides are the fastest types of mass movement and have proved to be significant events in terms of loss of life and infrastructure. Slow movements, such as soil creep and solifluction, cause fewer problems than quicker types of mass movement but they can still have negative effects on people.

D.6 Composite volcanoes tend to be located at convergent plate boundaries where subduction takes place. Shield volcanoes are located at divergent plate boundaries where plates are moving apart and also in areas where there is a hotspot. This means that there are linear patterns of these two types of volcanoes along the edges of convergent (composite) and divergent plate boundaries.

Cinder cone volcanoes can form where there is a hotspot and also away from a plate boundary where a fault line or weakness exists on a tectonic plate.

D.7 A hazard event of high magnitude generally occurs less infrequently while those of low magnitude have a higher frequency.

D.8 The Volcanic Explosivity Index (VEI) measures the explosivity of an eruption. This is a complex task due to the different types of eruptions, each of which produces different material such as lava or a pyroclastic flow. In addition, volcanoes can erupt for different durations. Therefore the main feature that is used in the Index is the volume of pyroclastic material that is emitted as well as the height of the eruption column and the duration of the eruption.

The scale has some use in being able to measure the power and associated consequences of a volcanic eruption, and so it is a useful magnitude scale as it quantifies the amount of material ejected during an eruption, the type of eruption and the frequency of it occurring.

D.9 Those countries with a history of geophysical hazard events will normally educate students on what they should do when an event takes place. Where there is low school enrolment due to access to education, people will have fewer opportunities to receive this information. In addition, higher levels of literacy will mean that people will be able to understand educational material produced by governments to inform its citizens about how to cope with a hazard event.

Knowledge about how to construct buildings and plan different types of land use in areas susceptible to hazard events will ensure greater resilience.

D.10 Economic factors are very important in either increasing or decreasing the risk when a geophysical hazard event takes place, such as the money that has been spent to make buildings resilient when faced with a 7.0 earthquake. Social factors are also important, such as ensuring that people have been educated about evacuation procedures when a volcanic eruption takes place. However, another factor that is important is location: the closer people are to an event, such as the epicentre of an earthquake or a pyroclastic flow, the greater the risk of death and destruction. The time of day is important too, since events that happen during the night while people are asleep mean that populations are more susceptible to injury or death.

D.11 Answers will vary. For an example, see the Rwankuba case study on page 58 of *IB Prepared Geography*.

D.12 There may be a lack of information so that people are not aware that a hazard risk exists. There may be a lack of communication infrastructure such as television, mobile phone coverage and internet. This may make it difficult for people to receive information about the possibility of an event taking place. A community may rely on the preparedness of the government and emergency services to ensure their safety.

D.13 Vulnerability refers to the susceptibility of a community to a hazard or the impact of a hazard event. It represents a range of socio-economic and demographic factors alongside a community's preparedness/ability to deal with a hazard event when it happens. Vulnerability can be reduced in a variety of ways and this can involve different stakeholders: the government, community groups, individual actions. For example, a government can relocate a community that is at risk from a volcano. Community groups can educate and inform their members about how to evacuate an area that is at risk from an earthquake, whilst individuals can take protective measures such as taking out insurance in order to offset the economic losses caused by a geophysical hazard event.

D.14 Very high risk areas are mainly located in Asia. Central, east, south, and south-east Asia all contain countries that are at very high risk from seismic hazards. In the western hemisphere, the very high risk areas are located on the west coast of the USA, Mexico, Central and South America. New Zealand is another country that is at very high risk.

D.15 Any from Delhi, Mexico City, Los Angeles, Osaka, Tokyo and Istanbul.

D.16 According to figure D.4.1, none of the countries listed are at a very high risk due to seismic activity.

D.17 The collapse of buildings is one of the major causes of death during an earthquake and if buildings can remain standing, then there will be a significant reduction in casualties. Chile, for example, has strict requirements for new buildings in its capital, Santiago, after experiencing a series of earthquakes during its history and despite high magnitude earthquakes, there has been a relatively minimal loss of life.

Modifications such as steel reinforcement, base isolators, movable hydraulic joints, strategies to reduce building shaking, shatter-proof glass, deep foundations can all be included when designing buildings such that seismic energy is absorbed, and the building does not collapse or suffer damage.

D.18 Slope stabilization is an effective way in which the threat from mass movement can be reduced. Depending on the local situation, a range of different strategies can be implemented such as draining a slope of moisture and planting vegetation. Local people can be made aware of the possibility of a slide or fall and the slope can be monitored on a regular basis. Warnings can be provided during a period of prolonged rainfall.

D.19 Deformations on the volcano can indicate the swelling of magma and the possibility of an eruption, whilst earthquakes will often precede a volcanic eruption. Earthquakes are more difficult to predict. The changes to gases and observing animal behaviour are just two of the unreliable ways that earthquakes can be predicted.

Since there are a range of different types of eruptions, it would be a generalization to state that all eruptions can be dealt with easily. For example, Plinian eruptions, which emit a large amount of gas and ash into the atmosphere, not only affect a place locally and nationally but also other parts of the world, and can, for example, disrupt air travel. There is little that authorities can do apart from evacuating people to as safe a place as possible and altering flight patterns. When earthquakes strike places of high population that are not prepared, the response is much more challenging for authorities compared to responding to a volcanic eruption.

Option E: Leisure, tourism and sport

E.1 Employment: The loss of a job will mean the loss of income, and that can make it difficult for someone to take part in leisure activities that they have to pay for. An increase in salary may mean new opportunities for leisure activities, although an increase in working hours will limit the time available for leisure.

The level of inflation: If the cost of buying goods and services increases, this will mean that consumers may not be able to afford to purchase them and thus cannot take part in the related leisure activity. The increased cost of buying essential items will also be higher, thus making it even more difficult to pursue leisure activities that have a cost. But if inflation is low and stable then more people will be able to participate in leisure activities.

Consumer confidence: This is linked to inflation and also other economic conditions. If the economy is unstable, for example during a recession, people may feel that they should try to save their money since jobs may be at risk.

E.2 The relationship is negative: generally, as the GDP per person increases, the amount of hours worked decreases. Thus the assumption is that the amount of time for leisure increases. For example, France has high GDP per person (approximately 2/3 GDP) with a low number of working hours (approximately 540/year) whereas Malawi is less than 1/64 GDP per person with working hours of 940 hours a year. The relationship is exponential in that at first, the number of hours decreases slowly compared to an increase in GDP per capita, but then the relationship becomes stronger as GDP increases above an 1/8 GDP per person as the number of working hours decreases.

E.3 One reason is the evolution of technology in order that people can now watch a wide range of television and films at home rather than visiting a cinema. In addition, online games can be played against others elsewhere in the world. This increased emphasis on home entertainment has occurred in countries such as the UK and USA.

Another reason is an increase in environmental stress in cities such as Shanghai where air pollution is quite severe. Residents want to escape this pollution, as well as the noise and overcrowding, and spend their leisure time in more rural areas where the air is cleaner.

E.4 Leisure is a freely chosen activity or experience that takes place in non-work time. Tourism involves visiting a place that is not your normal home for no longer than 1 year. A leisure activity can take place in your home and elsewhere, whereas tourism involves being away from home.

E.5 Economic factors could relate to affluence and the amount of disposable income; the availability of private sports facilities; level of public investment in sports facilities; and the cost of sporting equipment.

Social factors include gender access to certain sports; the ability for elderly people to take part in activities that would not be detrimental to their health; and education programmes available to promote the health benefits from taking part in sport. Sporting success at international sporting events could provide the stimulus for more citizens of that country to get involved in a particular sport.

Political factors include how governments promote particular sports; the investment in sports facilities; subsidies for sporting activities; and the creation of governing bodies for sport.

Environmental factors include the climatic or topographical conditions in a place that prevent or facilitate outdoor activities.

E.6 In many cities, gyms and yoga facilities tend to be located in a city centre, but they can also be present in edge of city locations as part of a larger sporting venue such as a gym within a tennis club. Yoga studios are often established in suburban areas. For larger venues such as stadiums, newer stadiums tend be located on the edge of cities whereas more historic stadiums are located closer to the centre. Areas requiring extensive amounts of land such as golf courses tend to be located on the rural-urban fringe.

E.7 These teams are spread throughout England. The highest concentration of teams is in the central areas and no teams are located on the south coast of England. There are outliers in the east of England, south Wales and to the west of London.

E.8 The location icons are obscured by other icons and it is impossible to see the distribution of all of the teams for each league.

E.9 A different icon could be used that is smaller such that each team is visible on the map. If the clustering is too heavy, then arrows could point to a place with the icon situated away from the actual location as to not obscure other icons.

E.10 Relevant factors affecting the locations of teams could include:

- Population density is sufficiently high so that there are sufficient people who will attend games involving the team, and therefore the salaries can be paid and the team is viable.
- Historically there has always been a team to represent the area.
- There may have been private and public investment to establish a team in a given area in order to provide employment and satisfy a need for a team to be established.
- Sufficient and affordable land is available on which to build a venue to house the team.

E.11 The only identifiable primary tourist resources would be the natural landscape of the countryside and the warm climate during the summer months.

The secondary tourist resources would be the nearby accommodation offsite from the festival, such as hotels in Nashville. Onsite would be all of the facilities provided, including the music and entertainment, the catering, the showers and toilets and campsite.

E.12 Heritage tourism is tourism based on the natural environment such as a landscape feature that has historical significance or it could be a landmark or settlement that has historical value.

E.13 A wide range of examples are applicable here, eg the Great Pyramids of Giza.

E.14 The strategy could involve the use of public and private investment to invest in the development of secondary touristic resources to support the primary touristic resources. Possible strategies that may be explored include investing in marketing and branding, infrastructure, investment in education and training for local people, providing subsidies and financial incentives for tourist developments, and specific planning legislation to support tourist development. In addition to developing tourism, part of the strategy may involve conserving primary tourist resources such that the economic benefits are sustainable.

E.15 The reasons for growth could include public and private investment, an increase in business confidence in a country, the development of infrastructure, increased employment opportunities (greater employment results in more taxable income revenue) and people have more disposable income while indirect jobs are created. During the event, visitors will spend money on food and accommodation, they will use public transportation, and visit places in the country or near the city.

E.16 The possible consequences could include:

- the large number of tourists will support jobs in the area such as those working in the stalls along the streets;
- increased intercultural awareness due to the exchange of cultural traits such as language;
- dissatisfaction from tourists due to the stress from experiencing an overcrowded area;
- the media could publicize the image and this would discourage people from visiting Barcelona, and so reduce the revenue from tourism;
- local people will find it difficult to walk in the area and this will create resentment towards the tourists.

E.17 Answers will vary. For an example, see the Barcelona case study on page 75 of *IB Prepared Geography*, where restrictions were placed on Housing Used for Tourism (HUTs).

E.18 Ecotourism is tourism that focuses on the conservation of the natural environment. An example would be the Monteverde Cloud Forest in Costa Rica.

E.19 The impact that sustainable tourism has on the environment is minimized and the activities that tourists take part in will contribute to the economy of the local area. The ecological footprint of activities is low as regulations are put in place to minimize any detrimental effect to the natural environment. The culture of a destination is respected and observed as well as protected.

E.20 Ecotourism is concerned with environmental sustainability whereas sustainable tourism relates to economic, social and environmental sustainability.

E.21 Environmental sustainability is a fundamental aim of ecotourism. When ecotourists want to visit places to enjoy the biodiversity there, it highlights the economic value of protecting nature to communities and administrations. Therefore regulations are implemented in order to conserve the environment for future generations. As part of the protection, local people can be employed (as guides, for example) and this provides locals with an economic incentive to understand the need to conserve the environment.

E.22 Sustainable tourism should support the environmental and local communities. Positive socio-economic impacts could include employment for local people, the development of infrastructure, reduced out-migration of people and sustaining communities, and improving intercultural understanding between tourists and local people. If tourists are not informed about local culture, then there could be a negative clash of cultures.

If management is inadequate, then there could be environmental degradation due to excessive tourist numbers, such as noise scaring animals away or footpath erosion. This will be detrimental to the companies who manage ecotourism, so it is in their interest to ensure this does not happen.

Option F: Food and health

F.1 One country, the Central African Republic, has an extremely severe GHI (greater or equal to 50) and a number of Sub-Saharan countries have a high GHI (35.0–49.9) eg Sudan, Chad and Zambia. Yemen in the Middle East also has a high GHI. Most of the countries with a GHI between 20–34.9 are located in Sub-Saharan Africa, South Asia and parts of the Middle East.

F.2 Nutrition transition refers to the change in diet that occurs as people become wealthier (and move from a low income to a middle income). Typically, this involves a greater intake of meat and dairy products, and a more varied diet.

F.3 The IMR is a useful indicator of development since it is relatively easy to reduce it with basic changes in development. For example, if there is an adequate food supply, access to clean water, good-quality accommodation and good sanitation, IMR levels will fall. They do not require expensive medical facilities in order to reduce. The IMR directly will reflect the quality of these basic provisions.

F.4 Health services are not merely a question of the number of doctors per person but also concern factors such as the facilities available in hospitals and clinics, the specialisms of the staff, access to primary health care and number of beds available.

F.5 Energy efficiency is high for agroforestry as the farmers utilize the natural forest to a large extent. There is some physical labour but not too much. No artificial fertilizers are used and the system is largely natural. In contrast, the dairy farm uses a lot of energy for processes such as milking, transport, making hay/silage and spreading chemical fertilizers on the fields. Also, the cattle use a lot of energy through respiration and mobility. The dairy system is energy intensive.

F.6 As animals need crops to feed on, their water footprint will include the water footprint of producing the crops, as well as their own needs for water. Meat products undergo more processing than crops, and this is included in the water footprint. Animals use water and energy in mobility, respiration, feeding and reproduction.

F.7 Some people may be reluctant because they are unsure about the benefits of a new technique/innovation. They might not be able to afford it, or they might not have the knowledge of how to use it. They may also mistrust change and prefer to see someone else try before they adopt it themselves.

F.8 Expansion diffusion occurs when the expanding disease has a source and diffuses outwards into new areas. In contrast, relocation diffusion occurs when the spreading disease moves into new areas, leaving behind its origin or the source of the disease. Contagious diffusion is the spread of an infectious disease through the direct contact of individuals with those infected. Hierarchical diffusion occurs when a phenomenon spreads through an ordered sequence of classes or places, for example from cities to large urban areas to small urban areas. Network diffusion occurs when a disease spreads via transportation and social networks eg the spread of HIV along transport routes.

F.9 **(a)** Areas in which malarial transmission occurs throughout include much of Sub-Saharan Africa, India and parts of the Amazon Basin. Some transmission occurs in south and east Asia, parts of the Middle East, the northern part of South America and central America. Transmission largely occurs in tropical areas.

(b) The anopheles mosquito that transmits malaria needs temperatures of 20°C to breed, so it is mainly located in tropical areas. Temperate and polar areas are too cold for the mosquitoes. They also require stagnant water to lay their eggs. Therefore they tend not to be found in deserts, where the water supply is limited.

F.10 Cholera is spread by poor water quality and is often associated with earthquake areas or slums. In contrast, malaria is found in areas where temperatures are between 20°C and 28°C, so that the mosquitoes can breed, and where there is stagnant water (for them to lay their eggs).

F.11 There are many ways in which TNCs influence global food consumption; for instance, in the production of food, food marketing and food sales. Some TNCs are major food producers (eg Monsanto, Bayer, Heinz). Global food supply chains are tightly integrated. Manufactured food is then passed on to global supermarkets (Sainsburys, Walmart, Lidl) and global fast food chains (McDonald's, KFC) and then sold to customers through these supermarkets and fast food chains. Advertising, marketing and pricing by TNCs help to create a demand for highly processed foods and therefore play a major part in influencing global food consumption.

F.12 **(a)** Life expectancy for women is generally higher than for men. This is the case in the top five countries. Life expectancy for women in the fifth highest country is higher than the life expectancy of men in the highest ranked country for males. However, for the country with the lowest life expectancy, Swaziland, women have a lower life expectancy than men (-1.8 years), and for the second lowest ranked country, Lesotho, the difference is just -0.1 year. However, from the third ranked country upwards, women's life expectancy is higher than that of men.

(b) It could be argued that men have a more "self-destructive" lifestyle. More men work full-time than women, and retire at a later age, and that may hasten their death. However, women in LICs have very physical jobs, which may explain, in part, the low life expectancy in those countries shown in the table. Poverty and diseases are likely to play an important part too.

F.13 Famine occurs when 20% of the population have access to fewer than 2,100 kilocalories of food per day; more than 30% of children must be acutely malnourished; and two deaths per day in every 10,000 people—or four deaths per day in every 10,000 children—occur due to lack of food.

F.14 To achieve food security a multi-sectoral approach needs to be adopted. Food security requires increased food production, access and utilization. It requires improved empowerment for women, for instance greater access to credit, finance and improved land tenure. It requires an increase in food production (improved access to water, fertilizers and land) but also improvements in storage (improved access to electricity) and transport. It may require better market access (mobile technology and increased awareness of market prices) and a more even household distribution of food (with equal values placed on girls and boys). It requires a more even share of household jobs (cooking, child-care, water collection) and greater access to preventative health care.

F.15 The advantages of in vitro food include the potential to produce a huge amount of food from a very small number of cells; engineering to give the in vitro meat health benefits; and the meat requires much less land and produces less greenhouse gases compared with traditional farming. However, there are significant difficulties of scale and cost to be overcome, and so the development of in vitro farming has been limited so far.

F.16 GM technology has helped farmers to increase yields by protecting crops against pests and weeds. Genetic engineering involves adding traits to a plant to make it grow faster and stronger, to be more nutritious or more resistant to disease or pesticides. Although herbicide tolerance technology does not appear to boost crop yields significantly or increase profitability, it saves time and makes weed management easier.

F.17 A pandemic could cause a global recession since many workers would be unfit to work, productivity would fall and the availability of food and manufactured goods may decrease. In addition, there would be less tourism, probably less retail trade and less cross-border trade. The world is still a globalized economy, connected by trade and travel, and any disruption to this would have an impact around the world.

F.18 The conditions that led to the successful containment of the Ebola virus included a massive public health campaign. Everyone exposed to the virus was found, monitored, and isolated if they developed the symptoms. TV broadcasts and social media were used to reassure people. Gatherings were banned. Markets and schools were closed, and school lessons were given over the radio.

Option G: Urban environments

G.1 For example, bustees, shanty towns, favela, squatter settlements.

G.2 This type of housing would normally be found on the outskirts of a city on the rural/urban fringe. More established informal housing may be located closer to the central business district (CBD) as the city has expanded around the informal settlement.

G.3 Illegal settlements tend to be located on poor, marginal land and there may be less chance of the settlement being demolished if the land is not desirable. For example, there could be mountains surrounding an urban area that are susceptible to landslides, or the land could be liable to flooding. Secondly, the city may not have any space in which to build a new informal settlement and the only available space may be on the outskirts of the city.

G.4 Migrants who arrive in a city with little wealth will be attracted to those areas with more affordable and cheaper housing. Therefore they may tend to congregate in areas such as the inner city in cities in HICs. An example would be Bangladeshi migrants residing in the borough of Tower Hamlets in central London.

Another reason will be that migrants may choose to live in areas where there may already be people from the same ethnic group. In these areas, people will speak the same language and other familiar cultural traits can be observed which creates a higher level of comfort. In addition, there could be family connections where members of an extended family have migrated earlier.

Migrants may also avoid certain areas where there is potential for conflict with either another ethnic group such as the indigenous population.

It is important to note that areas can traditionally have a certain ethnic group living in an area, but cities are dynamic and ethnic groups may leave an area as their wealth develops and be replaced by newer migrants with a lower income.

G.5 Rural to urban migration: Movement from the rural/urban fringe towards the inner city/inner suburbs.

G.6 This is a centripetal movement of people who tend to be from a higher socio-economic class in a city replacing residents from a lower socio-economic class. Often they want to live closer to their place of work, which is usually near a city centre. Housing could be cheaper in this area, so they can find a new home for a reasonable price and also live closer to their employment, which will mean a shorter commute to work. As the demand for housing in the area increases, the cost of buying accommodation or renting will increase. This means that existing residents will face an increase in the price of their property, which is beneficial if they are a home owner, but the property tax payable to the local government may also rise. Landlords will be inclined to increase the rent due to the demand for accommodation in the gentrified area. This will cause the existing lower socio-economic group to be displaced from the area as they will no longer be able to afford to live there. Different stakeholders in the process will have differing views about the process.

G.7 Push and pull factors are the forces behind migration to and from cities. Those cities that offer the possibility of employment will attract migrants from rural areas (rural–urban migration) or other smaller urban areas (inter-urban migration) whilst push factors such as urban stress will cause people to leave a city (counter-urbanization). Population change is caused by migration and the natural increase (the difference between the crude birth rate and crude death rate). Therefore if life expectancy is increasing and people continue to have children after they have migrated, then the population will grow.

G.8 The population of São Paulo has issues connected with waste treatment since a large amount is deposited into landfills rather than being recycled, although there is some recycling that takes place via teams that collect plastic and other materials. The employment of collection teams provides income and helps the city to become more sustainable, but with a large amount of solid waste going to landfill (98%), the city is clearly struggling to recycle the city's output.

G.9 Albedo is a measure of a surface's ability to reflect short-wave radiation. The lower the value or percentage, the greater the amount of heat absorbed by a surface. Ice has a high albedo rating, while a dark road will absorb much more heat and will therefore have a low albedo rating.

G.10 The temperature increases as you move towards the centre of the urban area.
It reaches a pinnacle at the central business district (CBD), changing from 85°F to 91°F.
Leaving the downtown area, the temperature decreases until suburban area, where the temperature increases by 1.5°F, and it then decreases again.

G.11 ***Rural/urban fringe:*** If vegetation is removed and replaced by concrete and man-made structures, the albedo will decrease and more heat will be absorbed, thus raising the temperature in this part of the urban area. The retention of the vegetation will ensure that the temperature remains low relative to other parts of the urban area since the albedo rating will be between 0.20 and 0.25 (the Earth's mean albedo rating is 0.36) compared to that of an asphalt road at 0.10 or lower.

Downtown: It may be possible to plant vegetation in a downtown area by creating small parks, and that can increase the albedo. In addition, roofs can become "green roofs" by planting vegetation on them, or they can be painted white ("cool roofs") which have an albedo rating of 0.80, further reflecting the radiation from the sun and cooling the city. The shade from the vegetation can also make this a more pleasant area for people as they commute to and from their jobs as it reduces the temperature.

Urban residential: Similar to the modifications for the downtown area, the same initiatives can be applied to the roofs of residential homes. As there is more available space the further you are from the centre of a city, there are more possibilities for creating more green spaces. Land-use zoning can ensure that areas are allocated for green space and not for man-made structures. The expansion of urban areas vertically and horizontally will increase the amount of heat due to the use of heating and air conditioning systems.

G.12 A microclimate includes wind speed, air quality and rainfall of an urban area as well as the temperature.

- The wind speed will change when there are tall buildings as these can create either wind canyons or areas that receive little wind or air flow. The planning of the street systems will also contribute to these two effects.
- An increase in rainfall will take place due to the upward movement of moist air when encountering tall buildings, and this will create condensation. The pollution and dust in an urban area will also increase the possibility of condensation and the formation of clouds. The increased temperatures in an urban area will also increase the chances of conventional rainfall occurring.
- The air quality will be affected by an increase in traffic, with gases such as nitrogen oxides being produced by vehicle exhausts. Alternatively, the implementation of traffic reduction strategies such as the congestion charge in London or the funding of public transportation such as the Metrobus system in Mexico City can reduce the amount of private transportation on a city's road network and therefore reduce the amount of pollution.

G.13 The relationship is negative—the lower the density, the higher the emissions.
The relationship is also non-linear. Atlanta has a population density of 10 people per hectare and individual emissions of 470 kg per capita whereas Seoul has a population density of 170 people per hectare and individual emissions of 55 kg per capita.
An anomaly would be Mexico City with a higher population density than many other cities and higher individual emissions.

G.14 Answers will vary. The differences may be explained by the following reasons:

- the number of individuals who own cars;
- the age of the cars—newer vehicles will be fitted with catalytic converters;
- the types of car—for example, the percentage of hybrid or electric vehicles owned;
- the amount of public transportation;
- the topography of where the city is located (since pollution can be contained when a city is surrounded by mountains);
- government legislation to reduce the amount of vehicles via permits or charges;
- the presence of prevailing winds may blow pollutants from elsewhere such as dust storms or from power stations that burn coal.

G.15 Individuals, non-governmental organizations (NGOs) and local and national governments all have a stake in trying to resolve urban stresses. For example, an individual can choose not to use their own private vehicle and use public transportation instead, therefore reducing their individual carbon emissions. On another note, individuals can seek out government training schemes in order to increase their knowledge and skills so that they are better placed to find employment, reducing the stress of unemployment.

G.16 Urbanization is the increasing percentage/proportion of a country's population living in towns and cities.

G.17 North America

G.18 Oceania

G.19 *[Editor's note: The question should read "Describe the projected change in the proportion of people living in urban areas in **Europe** between 1950 and 2050."]*
The proportion increases rapidly between 1950 and about 1990 (from 50% to around 70%). It increases more slowly between 2000 and 2050 (from about 70% to around 85%).

G.20 The urban ecological footprint is the theoretical measurement of the land and water that an urban area requires in order to produce the resources it consumes and to absorb its waste under current technology.

G.21 The urban ecological footprint can be decreased by reducing the amount of output generated in an urban area. This could involve people using bicycles or public transportation rather than private vehicles in order to reduce carbon emissions, or by composting food waste in homes which can then be used to grow fruit and vegetables. The installation of solar panels on homes can ensure that clean energy is provided in residential areas, and the surplus could be used elsewhere in the city where panels have not been installed. Alternatively the ecological footprint may increase as the population of a place grows. More people living in an urban area will mean greater use of water which may deplete freshwater sources and cause water stress or scarcity.

Unit 1: Changing population

1.1 Population distribution refers to where the population is located, whereas population density refers to how many people there are in a given area.

1.2 The main factors influencing high population density include a climate that is not too extreme (although South Asia's monsoon climate may be quite extreme), fertile soils, relatively flat land, river valleys, good accessibility, the location of mineral resources and the ability to trade.

1.3 **(a)** Most of the world's high-income countries are found in North America and north-west Europe. There are also regional clusters in east Asia (Japan and South Korea) and Oceania (Australia and New Zealand). Exceptions include a few oil-rich countries in the Middle East (Saudi Arabia and the UAE for example) and some in the southern part of South America. There are no high-income countries in Africa. Alternatively, some answers may state that most high-income countries are located in the northern hemisphere, although there are four in the southern hemisphere.

(b) In contrast, most of the world's low-income countries are found in sub-Saharan Africa, excluding southern Africa and many countries along the Atlantic coast of Africa. There are a small number of low-income counties in west and south Asia and one in east Asia (North Korea).

1.4 Most of the population are located in the area close to Roseau. There is a smaller concentration in the north, around Portsmouth. Most people live close to the coast—most of the population along the west coast are located in villages and small towns, whereas the population along the east coast are more scattered. There are relatively few people in the interior of the country.

1.5 Most of the people live near the coast because the land is flatter, low-lying and the coast provides employment in fishing and tourism. Agricultural land is also limited to the narrow coastal belt. There are relatively few people in the interior as the land is steep and high, thereby limiting potential for farming, settlement and transport.

1.6 Some cities develop into megacities because they have very favourable characteristics (also known as initial advantages). These may include having a deep, sheltered port, a good location for trade, flat fertile soils, a reliable supply of freshwater, a climate that is not too extreme and a government that is progressive. As a result of these initial advantages the city may develop and grow. Consequently, it develops acquired advantages—a young, entrepreneurial population, investment and infrastructure, which leads to more in-migration of workers and companies, keen to exploit the supply of labour and the new market. Under such conditions, some cities may develop into megacities.

1.7 There are a number of advantages of megacity growth. For example, megacities account for a small amount of land but a high percentage of population. They generate most of the world's wealth. They are a source of innovation and entrepreneurial activity, and they are a major source of employment and remittances.

On the other hand, they can be overcrowded and cause urban sprawl. There can be environmental issues occur such as air and water pollution, and degradation of natural ecosystems. Social and economic inequalities may lead to protest and conflict. Many urban residents lack rights to housing.

1.8 Most megacities develop at sites that encourage trade. As a result of this, and/or other advantages such as abundant supply of cheap labour, government incentives or resource endowment, industries develop. In turn, a process of cumulative causation (the multiplier effect) occurs as acquired advantages (for example improvements in infrastructure, skilled workforce, increased tax revenues and so on) are developed, and this reinforces the area's reputation and attracts further investment and labour migration from outside the area. This ensures that the megacity (the core) grows at the expense of the periphery, and the inequalities between them increase.

1.9 Physical geography has a huge influence on the distribution of population in China. Most of the population is concentrated in the eastern part of the country, especially in the coastal zone and the lower reaches of the main river valleys. In contrast, the western plateaus such as Tibet and Inner Mongolia contain less than 5% of the population on what amounts to 50% of China. Most of the coastal and river valleys areas are also the locations for industry, trade and commerce. Nevertheless, it is difficult to generalize about a country the size of China, with so many people.

1.10 The birth rate is the number of live births per 1,000 people per year. The death rate is the number of deaths per 1,000 people per year.

1.11 Ethiopia has a much higher birth rate than China (nearly three times higher) but it has a slightly lower death rate. However, life expectancy in China is nearly 15 years longer than in Ethiopia. Ethiopia has a much younger age-structure than China, a much higher fertility rate and also a higher dependency ratio.

1.12 Ethiopia has a much younger age structure than China, with over 40% of its population under the age of 15. This means that population growth is likely to remain high for some time to come. The fertility rate is much higher in Ethiopia. The majority of Ethiopia's population are rural farmers, and poverty is widespread. Hence, there is a need for children to help on farms, and to look after their parents in old age. In contrast, China is an urban, newly industrializing nation, where incomes are rising and children are not as vital in supplementing family income. Indeed, China's government introduced a one-child policy in 1979, although this was changed to a two-child policy in 2015, with the possibility of moving towards a three-child policy or abolishing constraints altogether.

1.13 **(a)** Use the following formula to calculate the natural increase:

Natural increase = (Birth rate − Death rate) × 100

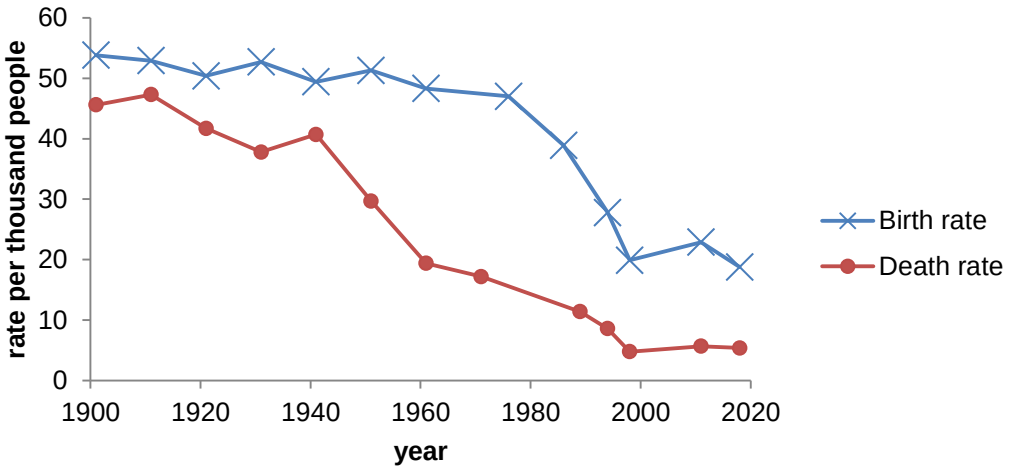
So for 1901–11, natural increase = $\left(\frac{53.8}{1000} - \frac{45.6}{1000}\right) \times 100 = 0.82\%$

Period	Birth rate (per thousand)	Death rate (per thousand)	Natural increase (%)
1901–11	53.8	45.6	0.82
1911–21	52.9	47.3	0.56
1921–31	50.4	41.7	0.87
1931–41	52.7	37.8	1.49
1941–51	49.4	40.7	0.87
1951–61	51.3	29.7	2.16
1961–74	48.3	19.4	2.89
1976	47.0	–	–
1971–80	–	17.2	–
1986	38.9	11.9	2.7
1989	–	11.4	–
1994	27.8	8.6	1.92
1998	19.9	4.8	1.51
2011	22.9	5.7	1.72
2018	18.8	5.4	1.34

(b) Natural increase was highest in 1961–1974.

(c) Overall, natural increase grew between 1901 and 1974, from less than 1% per annum to nearly 3% per annum, but fell to just over 1.3% per annum in 2018.

1.14



1.15 During the early part of the 20th century, birth rates and death rates remained high and fluctuating. Birth rates were generally higher than death rates, and so the population expanded. From about the 1940s, the death rate dropped significantly whereas the birth rate dropped only slightly, thus the population expanded rapidly. Around the late 1970s the birth rate began to drop sharply. The death rate continued to fall, but more slowly than before. From 2000 onwards both the birth and death rates appear to have risen slightly.

1.16 During the first part of the 20th century, Bangladesh was in Stage 1 of the Demographic Transition Model. From about the 1950s, Bangladesh was in Stage 2 of the DTM, the 'early expanding phase'. Around the late 1970s it entered Stage 3, the 'late expanding phase'. From 2000 onwards it does not fit into the model very well.

1.17 Increased potential for public transport/economies of scale/larger market/larger workforce; overcrowding/lack of space/disease/inequality/air, soil and water pollution, decline of biodiversity/environmental degradation/political discontent.

1.18 There are a huge number of jobs (with over 20 million unskilled workers living in PRD). Its GDP grew at more than twice the national average between 1978 and 2007, and the region has over 65 million residents—this will generate a large number of jobs in the service sector as well as in manufacturing.

1.19 Megacity growth can have many impacts on individuals. There are many jobs available and workers may find employment and earn good salaries. Many rural migrants may move to megacities in the search of higher paid jobs. Some may be lucky, but for many they experience family break-up, lengthy periods away from home, poor living conditions and low wages. For societies, megacities may be a source of wealth, centres of economic activity, technical and scientific innovation. However, they may also lead to urban sprawl, slum developments, high land prices, pollution, and social inequalities and political tensions.

1.20 Most displacements due to violence and conflict occur in Sub-Saharan Africa and the Middle East–North Africa region. These two regions account for about 70% of all displacements. Individual countries with large numbers of displaced include DR Congo, Syria, Iraq, Afghanistan, Yemen and Nigeria. These are all countries with long-standing civil wars taking place.

1.21 In some countries, such as China and India, there is traditionally a preference for male children and sex-selective abortion has reduced the number of girls that are born. In others, such as Russia, high mortality rates among men have led to a higher proportion of women surviving. In ageing societies, women generally outnumber men due to their longer life expectancy. In other countries, especially in the Middle East, the number of male migrants leads to a higher male population.

1.22 **(a)** The opportunities associated with an aging population include a large market for selected goods, for example, travel and health care (the 'silver'/grey market). Many of the younger elderly (for example 60–70-year-olds) are relatively fit, very experienced and have many skills; they can also help with childcare. On the other hand, there are costs such as pensions, nursing and care-home costs, subsidized transport and increased tax burden on workers.

(b) The opportunities associated with a youthful population include a large potential workforce; a large potential market for consumer goods; increased household income. However, a large youthful population requires education and health services. If there are not many jobs available, there could be high rates of unemployment, underemployment and/or out-migration. A youthful population is only beneficial if there are the resources to support them.

1.23 The regions with the greatest inequality are North Africa, the Middle East and south Asia. There is an exception in north-east Africa.

1.24 The map highlights the areas that are most unequal by using the darkest shading. This shows up clearly on the map. However, it is difficult to gauge the inequality in other areas. The scale also does not indicate whether the areas in white have no data.

1.25 The largest volume of people trafficked is in the Asia-Pacific region (nearly 12 million out of a total of nearly 21 million). The next largest is Africa with nearly 4 million victims. The Middle East has the least number of trafficked people. Asia-Pacific has the highest profits related to trafficking—over US$50 billion—but is it closely followed by developed economies (North America, Western Europe and Australia/New Zealand) with just under US$47 billion. However, in terms of profits per trafficked person, developed economies show a profit of US$34,800 per trafficked person, whereas in Africa it is US$3,900 per trafficked person and in Asia-Pacific it is US$5,000 per trafficked person.

1.26 The blue heart suggests the sadness of those who have been trafficked (feeling sad or 'blue') and blue represents the coldness (cold-hearted nature) of those who engage in trafficking.

Unit 2: Global climate—vulnerability and resilience

2.1 47%

2.2 Solar radiation is short wave whereas the Earth's radiation is long wave.

2.3 Incoming sources of energy in the atmosphere include short-wave radiation absorbed by gases in the atmosphere (19 units); short-wave radiation absorbed by the clouds (4 units); absorbed long-wave radiation from the earth's surface (104 units), from convection currents (5 units), and from condensation/deposition of water vapour (24 units). All of this totals 156 units. Outgoing energy from the atmosphere includes longwave radiation emitted to the Earth's surface by gases in the atmosphere (98 units), long-wave radiation emitted to space by gases in the atmosphere (49 units) and long-wave radiation emitted to space by clouds (9 units), totalling 156 units.

2.4 At the Earth's surface, sources of incoming energy include absorbed short-wave radiation from the sun (47 units) and absorbed long-wave radiation from gases in the atmosphere (98 units), totalling 145 units. Outgoing energy from the Earth's surface include long-wave radiation emitted by the earth's surface (116 units), removal of heat through convection (5 units) and heat used in evaporation and sublimation (24 units). That is 145 units in total. Thus, there is a balance between incoming and outgoing radiation at the Earth's surface.

2.5 The greenhouse effect is a natural process in which greenhouse gases (water vapour carbon dioxide and methane, for example) allow short-wave radiation from the Sun to pass through the atmosphere but trap a proportion of the outgoing long-wave radiation, thereby warming the atmosphere. The enhanced greenhouse effect is the increasing amount of greenhouse gases, notably carbon dioxide, that have been added to the atmosphere, largely as a result of human activities, which have led to accelerated heating over the last 100 years or so.

2.6 Global dimming may be caused by natural events, such as volcanic eruptions, and the pollution caused by humans. Particulates, especially soot and carbon, act as condensation nuclei for water droplets that form clouds. However, the droplets are more numerous and smaller than droplets in natural clouds, and they reflect more sunlight. This prevents some sunlight from reaching the Earth's surface and thereby reduces some of the impact of the enhanced greenhouse effect.

2.7 As temperatures in high latitudes and high altitudes rise, more snow and ice will melt. Snow and ice are highly reflective (that is, they have a high albedo). However, if they are replaced by a darker surface, for example, bare rock or soil, or by a vegetated surface, there is a change in the albedo. The darker surface is less reflective and instead absorbs more short-wave radiation. This leads to an increase in the amount of long-wave radiation emitted by the surface, which may lead to warmer temperatures, more melting of snow and ice and a positive feedback loop.

2.8 As temperatures rise, an increasing amount of permafrost is likely to melt. Permafrost contains large amounts of methane, and as it melts it releases methane into the atmosphere. Methane is a greenhouse gas and is much more powerful than CO_2. Hence, the release of methane may lead to an increase in the amount of long-wave radiation that is trapped, and so global temperatures may increase, and these may increase the release of permafrost. This is an example of positive feedback.

2.9 It is possible that emissions in HICs will stabilize or fall, partly due to less agricultural production and less industrial activity, and also due to the increase in the environmental movement. In contrast, it is likely that the emissions from emerging economies (MICs) will increase as they continue to industrialize and their standards of living rise. In contrast, emissions in LICs will probably remain, especially for the poorest countries.

2.10 **(a)** In some areas, crop yields will reduce due to warmer and drier conditions. For example, in sub-Saharan Africa, an increase of 1.5–2.0°C will lead to a decrease of millet and sorghum areas by 40–80%. Many savanna areas will become too dry for farming. The potential for soil erosion, land degradation and desertification in dry areas is likely to increase. However, in some areas there may an improvement in yields. The limits of cultivation may move further north in North America and Russia due to rising temperatures in the tundra which will lead to the possibility of agriculture and increasing growing seasons.

(b) There are a number of potential changes to ecosystems. Climate change may increase the extinction of species in sensitive areas. It may affect the capacity of ecosystems to survive extreme events, such as fires, droughts and floods. Mountain and arctic ecosystems are especially vulnerable, as species have fewer places in which to take refuge. Many fish species have already migrated to higher latitudes and warmer conditions. As rivers get warmer, warm water fish species are replacing coldwater species such as trout and salmon. The coldwater species are projected to lose around 50% of their habitat by 2080. The impact of climate change can pass up through the food web. However, some areas will become more productive. Tree lines are expected to rise in many mountainous areas in response to warming conditions.

2.11 **(a)** Vulnerability varies according to location for many reasons. For example, low-lying coastal areas are vulnerable to sea-level rise; floodplains are vulnerable to river flooding; steep slopes are vulnerable to mass movements. All of these may become more vulnerable to hazard events as global warming progresses.

(b) Vulnerability generally decreases with wealth, as richer households can afford to live in better accommodation in safer areas and may be able to leave an area if a hazard event threatens.

(c) Women may be more vulnerable to climate change as they are the main carers in families and generally care for older relatives/small children. For example, in the event of a hurricane, they are more likely to stay in the risk area to care for the young or the infirm.

(d) Elderly people may be less able to flee from a hurricane event, and less able to fend for themselves. For example, in times of drought, they may be more at risk of heatstroke. Young children may also be unable to care for themselves and depend on adults for support.

(e) Education has an influence on occupation and level of wealth. Those who are more educated may have a greater awareness of the threats posed by climate change and be more able to take action. For those leaving an area, highly skilled immigrants often have a better chance of employment than unskilled migrants.

(f) Risk perception influences whether a person is a risk taker or a fatalist, or whether they try to minimize risk. The action taken may depend on the person's perception.

2.12 The River Thames flows through London and it is a potential source of flooding. Around 15% of the population of London live on the Thames flood plain. London is also influenced by tidal flooding from the North Sea. Sea level is rising (albeit slowly), increasing the risk of coastal flooding.

2.13 The city experienced three dry years in a row, causing water capacity to fall to 17% of capacity. Farming and tourism are heavy users of water, and some people use more water than they need.

2.14 The city's authorities planned to shut down residential supplies of water and to provide water via standpipes. They recommended that daily water use was limited to 50 litres. Farms and hotels halved their use of water.

2.15 Wave refraction concentrates erosion on the flanks of a headland. Weaknesses such as joints or cracks in the rock are exploited, forming caves. Caves enlarge and are eroded back into the headland until eventually the caves from each side meet and an arch is formed.

2.16 One advantage of desalination is that there is an almost unlimited supply of seawater. One disadvantage is that it is very costly to build desalination plants.

2.17 London is a city in a rich country, and so should have more funding available to tackle climate change issues. It has a tidal barrier to prevent tidal flooding; it has coped with droughts and floods in the past, so should be able to upgrade flood defences. It has an underground train network and has to have strategies in place to deal with flooding or over-heating.

2.18 **(a)** Carbon offset schemes are designed to neutralize the effects of the carbon dioxide produced by human activities by investing in projects that cut emissions elsewhere. Some climate experts say offsets are dangerous because they dissuade people from changing their behaviour.

(b) Geo-engineering schemes are large-scale engineering schemes that alter natural processes. For example, releasing sulphate aerosol particles in the air could be used to dim the incoming sunlight and thereby cool the planet. Another potential scheme is to place giant mirrors in space to deflect some of the incoming solar radiation. These are fairly radical, expensive and perhaps unworkable ideas.

(c) Carbon capture: When fossil fuels are burned, the CO_2 enters the atmosphere, where it may reside for decades or centuries. One potential solution is to capture the CO_2 before it is released into the atmosphere. There are two main ways to do this:

(i) Capture the CO_2 at the site where it is produced (the power plant) and then store it underground in a geologic deposit.

(ii) Allow the CO_2 to enter the atmosphere but then remove it using specially designed removal processes.

(d) Ocean fertilization: Carbon dioxide absorption can be increased by fertilizing the ocean with compounds of iron, nitrogen and phosphorus. This introduces nutrients to the upper oceans, increases marine food production and takes carbon dioxide from the atmosphere. It may trigger an algal bloom, which can trap carbon dioxide and sink to the ocean floor.

2.19 **(a)** Early-warning system, emergency shelters, seas walls, desalination and/or migration.

(b) Early-warning system, new forms of agriculture, genetic engineering/HYVs, irrigation, desalination and/or migration.

2.20 Civil societies play an important role in the fight against climate change. They raise public awareness, help with funding and enter into partnerships with other organizations that are trying to limit the impacts of climate change. However, despite their initiatives, climate change continues to occur and would appear to be accelerating. However, without the work of civil societies, the impact of climate change might be even worse.

Unit 3: Global resource consumption and security

3.1 In 2009, the largest proportion (over one-third) of the world's middle class was in Europe, followed by Asia Pacific and North America. Europe has twice as many middle class people as North America. By 2020, Asia-Pacific's middle class is predicted to account for over half of the world's middle class, with over three times as many middle class people as in 2009. Although the number of middle class people in Europe increases, its share of the global total decreases by over one-third. North America's middle class population decreases slightly but its relative share almost halves, The proportion in sub-Saharan Africa and in the Middle East and North Africa remains relatively constant over the period.

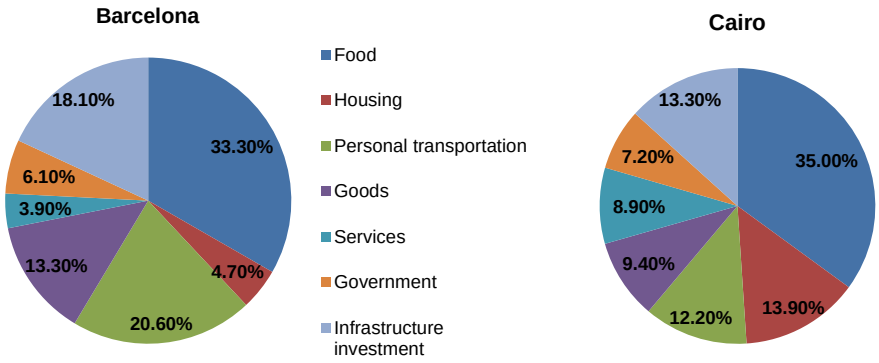
3.2 The scale used is a log-normal scale (or semi-log scale). The normal scale on the vertical axis is used because the intervals in percentages are all equal. However, on the horizontal scale, the intervals in income vary from 100 to 1,000 (102-103), 1,000-10,000 (103 -104) and 10,000 to 100,000 (104-105) (ie a logarithmic scale). A linear scale with intervals of 10,000s would not show values for 100 or 1,000 clearly, but a logarithmic scale, increasing by multiples of ten (in this case) is able to show very low values and very high values clearly.

3.3 It is predicted that by 2020, no one will have an income of below US$2/day, but about 20–24% will have an income of between US$2 and US$5/day, a further 30% would have an income of US$5–10/day, and over 40% would have an income of between US$10–100/day. The same trend continues towards 2030, although the increase in income is not as marked. For example, a very small proportion (less than 5%) have an income of less than US$5/day, around 20% have an income of US$5–10, but over 75% have an income of US$10–100/day.

3.4 They are oil-rich countries from the Middle East.

3.5 The countries with the lowest ecological footprints are LICs. There is greater similarity of ecological footprints among the countries with low EFP compared with countries with a high EFP.

3.6



Barcelona has a much higher ecological footprint than Cairo, nearly 60% higher. Both have a similar percentage of their footprint coming from food and government, but Barcelona has a much greater input from personal transport whereas Cairo has a much higher input from housing.

3.7 Much of Cairo is desert and so is relatively unproductive, whereas the Barcelona region in Spain has a higher proportion of productive land.

3.8 Urban ecological footprints are higher than rural ecological footprints because much of the food consumed in urban areas has to be imported (food miles). On average, urban residents are wealthier than rural residents, and have a higher disposable income, and buy more consumer goods.

3.9 Urban areas have greater potential for public transport and mass-transit systems, so relatively fewer people use their own car. In rural areas, public transport is less developed and more people rely on their own car for travel.

3.10 **(i)** Industrialized countries

(ii) Sub-Saharan Africa

3.11 **(i)** South Asia

(ii) Sub-Saharan Africa

3.12 The scale "million tonnes of oil equivalent" is used since the different energy resources provide different amounts of energy per unit. For example, one tonne of oil may produce more energy than one tonne of coal. Therefore, to make the contributions comparable, the amount of energy produced by each sector is made into the equivalent amount of oil that would be needed to produce the same amount of energy.

3.13 The type of graph being used is a compound line graph. In this example, the reading for energy type starts at a different level eg the reading for coal starts on top of the reading for renewable, whereas the reading for nuclear energy is found on top of that for natural gas. This type of graph is useful because it can show total energy as well as the individual readings.

3.14 The total amount of energy consumed has risen from approximately 8,000 mtoe in 1991 to just over 13,000 mtoe in 2016, an increase of around 60%. Oil still accounts for the largest share of energy consumed, rising from ~3,000 mtoe in 1991 (~37% of energy consumption) to ~4,500 mtoe in 2016 (35%), although its relative share has fallen. Coal had the second largest share in 1991 (~31%), but this fell to 27% in 2016, despite the increase in consumption from 2,500 mtoe to 3,500 mtoe. The share of natural gas rose from ~22% to ~23%, while the share of the alternatives (nuclear, hydroelectric and renewables) increased from ~12% to ~15%.

3.15 Climate change may lead to there being less water available in California, and this could affect the amount needed for irrigation, and the amount available for irrigation. Higher temperatures can lead to more evaporation, and greater use of energy to supply irrigation water. Higher temperatures may increase plant stress, and could lead to falling crop yields.

3.16 Two advantages of global climate change for the food–energy–water nexus could be higher productivity in some regions due to rising temperatures (especially in boreal and Arctic regions), and some crops may be grown in areas previously too cold for them to grow in. Two disadvantages of global climate change for the food–energy–water nexus could be the increased evapotranspiration resulting from higher temperatures, leading to water-stressed crops, and the increased need for energy resources to run air-conditioning in warmer regions.

3.17 Two positive aspects of the relocation of e-waste to LICs are the jobs that it creates, and the income it provides for the workers in the trade. However, working conditions are hazardous, pay is poor, and there have been increased instances of lead poisoning, cancer and miscarriages.

3.18 Both the Malthusian and the neo-Malthusian view of population growth and the growth are pessimistic, ie they believe that population growth will exceed the capacity of the world's resources. However, Malthus suggested that there were natural checks (such as war, famine and disease) and artificial checks (eg delayed age of marriage and/or abstinence from sex within marriage). He did not approve of artificial family planning (contraceptives) or abortion. In contrast, the neo-Malthusians accept that contraceptive and abortion may be a way in which population growth could be controlled.

3.19 Increased demand for food leads to increased pressure to find new food sources/supplies eg intensification, use of fertilizers, increased irrigation, new types of food eg insects.

3.20 Sen and Devereux highlight the importance of factors other than just population growth and availability of resources. For Sen, economic factors are crucial, while for Devereux, politics, natural disasters, climate change and environmental issues are also important in the debate about population and resources.

3.21 "Resource stewardship" requires careful management of resources, so that sustainable development can be achieved. People should look after the environment so that they maximize benefits for their own good.

3.22 People can use resources at the maximum sustainable yield so that they can have a long-term sustainable use of resources, rather than exploiting resources in a short term.

3.23 A circular economy is one that preserves natural capacity, optimizes resource use and reduces loss through managing finite stocks and renewable flows. It is an economy that restores and regenerates resources, and keeps products, materials and components at their highest utility and value.

3.24 Methane from cattle manure can be used to produce natural gas, or their manure can be used as a fertilizer and return nutrients to the soil. In the USA and Argentina, "back-packs" have been used on cattle to trap some of the methane they emit, and this is then used to produce natural gas.

Unit 4: Power, places and networks (HL only)

4.1 Globalization is the increasing interdependence of countries. This includes economic systems, physical systems (such as global warming), socio-cultural systems (such as fashion, music and the film industry) and political systems.

4.2 Some advantages of using the indices of globalization, such as the KOF index, include:

- it allows for comparisons to be made for a single country or groups of countries;
- it (KOF) has been calculated for a large number of countries since 1970;
- it makes use of 24 variables covering three main areas of globalization (economic, social and political) so it covers a wide range of globalization data.
- it uses data that is likely to be readily available eg number of McDonalds restaurants.

4.3 There are a number of disadvantages of using indices of globalization, such as the KOF Index**:**

- smaller countries are over-represented at the top of the rankings, suggesting there may be some bias in how the final values are calculated eg being part of the EU makes countries more globalized;
- the relevance of using international mail seems low given the rise of email and the internet;
- many countries have large numbers of undocumented migrants, which are not taken into account in the KOF;
- by publishing ranking, the KOF seem to be implying that those at the top are “better” than those at the bottom. This is not necessarily true as globalization brings problems as well as benefits to countries.

4.4 Hard power is the ability to change a country or area with the use of force or coercion. In contrast, soft power refers to the ability to change a country, area or population through means such as culture, education, aid, investment and support.

4.5 The G7 countries are all very similar (high-income countries) so they are more likely to reach agreement in discussions. However, they do not represent any low-income countries or emerging nations, and there is no representation from Africa or South America.
It is unreasonable to expect seven countries to provide all the solutions for all of the world’s countries.

4.6 The G20 countries cover a large part of the world, and are present in all continents. However, the representative countries from Africa and the Middle East are very limited. In contrast, the G7 countries are high-income countries, and are largely drawn from North America and Western Europe. Japan is the exception. The G7 countries represent a much smaller proportion of the Earth’s population than the G20 countries.

4.7 The OECD countries are limited to high-income countries (and Turkey/Mexico). The map of OECD countries is very similar to the G7 map. It does not represent emerging nations or low-income countries (except for Mexico and Turkey).

4.8 **(a)** Bilateral surveillance is the appraisal and advice given by the IMF to each member country.

(b) Multilateral surveillance is the IMF overseeing monetary systems and economic developments of the world economy.

4.9 "Capacity development" refers to any development eg school, hospitals, transport infrastructure, economic policy and legal framework—that can help foster a stable economic environment and help improve growth and create jobs. "Lending" refers to the financial assistance that is given to help member countries stabilize their economies and restore sustainable economic growth.

4.10 The focus of the NDB on emerging economies and low-income countries is positive, as is the promotion of sustainable energy. However, the number of projects is very small and unlikely to have a major impact on non-renewable energy sources. In addition, the annual budget is relatively low given the scale of its ambitions (encouraging sustainable development schemes).

4.11 In 1990, about 50% of world trade, by volume, was between HICs. A further 15-20% was from HICs to LICs, and up to 40% was from LICs to HICs. The volume of trade between LICs was relatively small.

Since then, the proportion of trade between HICs had gone down to about 30%, trade between LICs had risen to around 20%, and trade between LICs and China had risen to around 10%. The volume of trade from HICs to China had also increased.

4.12 **(a)** Most of the top ten borrowers from the World Bank, 1945–2015, were emerging nations/newly industrializing countries/semi-periphery countries. There were none from Africa.

(b) The top ten borrowers from the IBRD, in 2015, were mainly emerging nations. Three were Asian, three European and two from both South America and North Africa. There were no countries from sub-Saharan Africa.

(c) The countries were a mix of low-income countries and emerging nations. Five were from sub-Saharan Africa and five from Asia.

4.13 Thirty of the 36 countries are found in sub-Saharan Africa (excluding southern Africa). There are three in Latin America and the Caribbean and two in South America. Only one is located in Asia.

4.14 As the percentage of government revenue going towards debt is reduced, the government can use funds into development projects. No debt means nations can be autonomous from organizations such as the World Bank or International Monetary Fund in terms of pathways to economic development; less debt means less need for more loans to pay off interest.

4.15 **(a)** India and China receive the largest amount of remittances as they are likely to have the largest number of migrants working abroad. Mexico receives a large amount of remittances as it is located next to the USA, a major source of employment and income. Many people from the Philippines migrate to the Middle East and send large amounts of money home.

(b) Some of the countries where remittances account for a large amount of GDP include poor countries where employment opportunities may be limited, eg Nepal and Tonga. Others have been badly affected by natural hazards, eg Haiti and Honduras, and so employment opportunities have suffered. Others such as Kyrgyz Republic, Tajikistan and Moldova were part of the former Soviet Union and many of the workers continue to work in Russia and send remittances to their families.

4.16 There are many reasons why companies become involved with other countries. These include greater access to raw materials, to access new and emerging markets, to locate within a trading bloc and to gain access to lower paid workers.

4.17 MGOs, such as the CPTPP, give increased access to markets, raw materials, cheap and/or skilled labour.

If the MGO changes from an economic union to a political union there may be a loss of sovereignty and or decision making. Also, it opens up the economy of each nation to that of all other nations within the MGO.

4.18 The UK has recently voted to leave one trading bloc, the European Union. Moreover, it is not in the Pacific rim.

4.19 One advantage is that there is an increase in economic output, infrastructure and attraction of foreign direct investment.

On the other hand, much government revenue is directed towards outside companies/infrastructure rather than for social welfare for its own citizens.

4.20 In some countries, such as the USA, some people fear that migrants will take over many of the low paid, unskilled jobs. In other countries, such as the UK, some people think that migrants require free housing, schooling and healthcare and that they are an economic drain on the country. However, evidence from University College London suggests that EU migrants to the UK are an asset to the country.

4.21 **(a)** The main winners as a result of changing data flows are rich countries, and countries with good access to ICT and a skilled workforce eg India. In contrast, very poor countries, and those without much ICT infrastructure, or heavily-censored countries, have not benefited as much from ICT.

(b) Transport developments have again benefited rich countries and coastal countries with access to deepwater ports, eg Singapore. The countries that have benefited least include poor ones and landlocked countries, such as South Sudan.

4.22 To a large extent, digitization has not made the benefits of globalization available to all countries/peoples. For example, while over 80% of developed economies have data on ICT use by businesses (2003–2016), the least developed countries have less than 5%. This suggests that access to ICT is much lower in the least developed countries, and that (unlike developed economies that benefit from a shrinking world and greater communications and integration) the least developed countries do not benefit. This further reinforces disparities in level of development.

Unit 5: Human development and diversity (HL only)

5.1 Inclusive means that everyone has equal rights to receive the same opportunities as everyone else—there should be no bias in terms of sex, gender, age, ethnicity, race, colour or religion. Foster means to encourage or to develop. LDCs stands for least developed countries (or landlocked developing countries). SIDS stands for sudden infant death syndrome.

5.2 The SDGs concerned with environmental issues include Goal 6, Ensure availability and sustainable management of water and sanitation for all; Goal 7, Ensure access to affordable, reliable, sustainable and modern energy for all; Goal 13: Take urgent action to combat climate change and its impacts; Goal 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development, and Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

5.3 Gender inequalities remain; for example, some 20% of women in a relationship have been subjected to physical and/or sexual violence; 25% of women aged 20-24 were married before the age of 18, and less than 33% of senior- and middle-management positions are held by women.

5.4 The highest HDIs are found in the northern hemisphere, in particular North America, Western Europe and Russia. There are also high rates in Australia/New Zealand, parts of the Middle East (Saudi Arabia and the UAE) and Argentina. The lowest rates are generally found in sub-Saharan Africa and Afghanistan.

5.5 The UAE has a very high HDI (0.840) with a very high life expectancy, 77.1 years. However, its mean years of schooling is about four years lower than the expected years of schooling. Its GNI ranking is much higher than its HDI ranking (by 35 points) suggesting that its wealth may not have been equally shared in social sectors as well as economic ones.

5.6 The structure of the Gender Inequality Index is very different in the two countries. For example, in relation to the maternal mortality rate, Chad's MMR of 856 per 100,000 live births is more than 50% higher than Niger's (553 per 100,000). On the other hand, Niger's adolescent birth rate of 202.4‰ is more than 50% higher than Chad's 133.5‰. Both have a similar number of women in government, and both are very low, less than 15%. Both have very low proportions of women aged over 25 years with at least some secondary education. However, males in Niger are twice as likely as women to have some secondary education whereas males in Chad are four times more likely. Finally, there are clear gender differences in labour force participation. In Niger, compared to women, males are more than twice as likely to participate in the labour force, but in Chad the difference is much less marked.

5.7 The UAE has a moderately high GII (0.232) and is ranked 46th in the world (it has the world's 42nd highest HDI). It has a low maternal mortality ratio but a relatively high adolescent fertility rate. The percentage of women with some secondary education is higher than that for men, but there are significantly fewer women (41.9%) participating in the labour force than men (91.6%).

5.8 Women make up a greater share of the world's poor, own a very small percentage of the world's land, make up a disproportionate amount of the world's refugees, experience large amounts of domestic violence, and are much less likely to have the top jobs in most companies.

5.9 Paying men and women the same wage for the same job; provide education for all children.

5.10 Indigenous people are more likely to live directly from the land eg as farmers. The land may have a spiritual meaning to them, as well as an economic one.

5.11 Many indigenous people are losing their lands, which also means they are losing their culture, livelihoods and rights. Indigenous people account for 5% of the world's population, but 15% of the world's poor. In general, they have limited influence and participation in the national economy of where they live. They often experience poor health and high infant mortality rates.

5.12 One advantage of microfinance is that it can provide money to poor people to help them improve their lives. However, it may cause them to get into debt as the interest repayments can be high.

5.13 The advantages include that it pays farmers a fair wage; it improves worker safety and it reduces the need for child labour. However, disadvantages include less demand for more expensive goods; there is also less choice with fair trade products.

5.14 CSR aims to help workers—employers should pay a fair wage, provide good working conditions and improve worker safety. It is also good for the company—it helps to create a "positive image" which will help to boost sales, whereas poor publicity could hit sales.

5.15 Cities may choose to be similar to other cities if they associate them with development and progress. On the other hand, it could be the TNCs choosing the cities—they want to expand their global brand, reach into new markets, and possibly access areas of cheaper labour. Many of the companies that are located around the world are global leaders, and so for cities to appear progressive, they need to attract such global companies.

5.16 **(a)** The number of global languages has been declining since the 1970s. English has become the dominant world language, especially of business and the internet. There are a number of languages with over 100 million native speakers—English, Mandarin, Spanish, Portuguese, Hindi, Arabic, Russian and Bengali. In contrast, a number of indigenous languages are disappearing (eg Manx and Cornish) and it is suggested that 3,000 languages could disappear by 2100.

(b) Although the number of media channels has proliferated, some 20 to 30 large TNCs dominate the global media industry, mainly from the West and predominantly the USA. These include giants such as Time Warner, Disney, Fox and the BBC. However, some non-Western media companies have also become important such as Al Jazeera and Russia Today.

5.17 The reasons for the decline in languages and the growth in large-scale media TNCs is related to the growth of ICT, the spread of media "soft power" and the ability of people around the world to connect into media networks. Digital TV and internet providers make TV programmes and films available throughout the world. Consumers wish to keep up with the latest trends/fashions/development/sports and through the Internet they can get connected. As people become wealthier, their lifestyle changes and many follow a more-Western lifestyle.

5.18 Many urban landscapes in different countries today look very similar. Tall towers are a feature of many cities. Industrial estates and science parks are increasingly globalized. Many cities have pedestrianized shopping centres, open markets and out-of-town supermarkets. Many large cities have Chinatowns and other ethnic or racial areas. Global TNCs such as McDonalds, Starbucks and Santander are found in many of the world's main cities. Many cities have similar design features eg new tower blocks often contain large amounts of reflective glass.

5.19 There are a number of reasons why urban areas are becoming more similar: the spread of consumer culture; the desire of TNCs to reach more markets; the use of a limited number of top architects around the world; planners wishing to copy what they consider to be good designs that are found elsewhere.

5.20 A very large quantity of food is produced; it is generally available year-round; it is of a standard quality; supplies are generally reliable; and the cost of the food is relatively low.

5.21 It is very small scale. It is likely providing locally produced goods such as vegetables, bread, cheese, jams, as well as horticultural products.

5.22 Locally produced food may be seasonal and limited in quantity, and there may be a smaller range of products. Also it may be more expensive compared with mass-produced food.

5.23 Germany had the highest proportion of people in favour of immigration. This may be because Germany has an ageing population and in time a declining workforce will need to be boosted by migrants. Britain had the second highest proportion of people in favour of immigrants, yet it voted to leave the EU, partly because of fear over a lack of control over migration. In contrast, Greece and Italy are more likely to be against migrants, possibly due to the number of immigrants in these countries and the recent rise of nationalism in Europe. Countries with a higher proportion of unskilled labour may also be more anti-immigrant as many low-skilled workers in rich countries fear that they will lose their jobs to immigrants. Skilled workers, on the other hand, have less to fear, and largely see the benefits of immigrants.

5.24 The country with the highest level of protectionist policies is the USA. It is the world's largest economy, a developed country, and wealthy. Generally the countries with over 300 protectionist policies are large economies, large countries and HICs or NICs (emerging economies).

5.25 The lowest levels of protectionist policies are found in Africa (with the exception of South Africa), parts of the Middle East, parts of South Asia, and Central and South America. Two notable exceptions include Iceland and Norway, which are HICs but with low levels of protectionism.

5.26 The arguments for protectionism include protecting jobs in the home country, using natural resources at home rather than cheap imports, and paying less to foreign companies. However, the arguments against protectionism include higher prices for home-produced goods, and falling demand in suppliers from LICs.

5.27 The rise of resource nationalism has been linked to the global recession, increased competition with new and emerging producers and increased unemployment in HICs and NICs/emerging markets.

5.28 Of the global population, less than 25% have freedom of access to the internet. Nearly 40% of the world's population do not have free access to the internet and access for a further 29% is only partially free. Thus, nearly two-thirds of the world's population have restricted access to the internet. Twelve per cent were not assessed for internet freedom.

5.29 Social media helps individuals, organizations and governments to communicate. It can help transmit information. A good example of how it can operate is provided by the Arab Spring of 2010 onwards. In countries where Al Jazeera and the BBC provided widespread coverage, such as Egypt, mass violence by the government and the military was suppressed. In countries which had greater access to social media, more support was mobilized for the protests.

Unit 6: Global risks and resilience (HL only)

6.1 It is on the increase and rose by about 50% between 2007 and 2016.

6.2 The number of identity theft occurrences is extremely high—19 victims per minute—but on average it takes far longer to resolve the issue—up to 30 hours—and at a cost on average of US$500 per victim.

6.3 The main advantages in global supply chains include reduced costs, increased reliability, increased efficiency, and increased competitiveness due to access to cheaper resources. At a local level global supply chains do not face any trade barriers, import and export duties or variations in exchange rates.

The disadvantages of global supply chains include the difficulties of coordinating numerous supply chains, complex tax systems and variations in exchange rates. At a local level, they might not have access to cheap resources or proximity to a global market. Global supply chains have been increasingly disrupted in recent years due to increased protectionism and trade barriers eg between the EU and the USA, and between the USA and China.

6.4 The main environmental risks associated with global supply chains include extreme weather events, which may damage property, infrastructure, products, environmental damage and even loss of life. Biodiversity loss and environmental degradation could cause irreversible loss to the environment, leading to resource depletion for people and for industry. Natural disasters may also cause damage to people, property, industries and infrastructure. Accidental (and non-accidental) environmental damage (eg oil spills and/or radioactive contamination) may also have an impact on supply chains.

6.5 According to US researchers, the US's largest companies hold around US$2.5 trillion of profits in offshore accounts to avoid paying tax. Consequently, the US government is losing out on around US$100 million of unpaid taxes from some of the richest TNCs. If these taxes were paid it would be the equivalent of the GDP of Saudi Arabia or Switzerland. Consequently, the government has less money to spend on things like education, health care or social welfare. Some wealthy individuals also choose to place money in offshore accounts. Although it is not illegal it is unethical. It creates victims, since governments with fewer taxes are less able to provide welfare payments of fund development schemes.

6.6 Localization/tribalism refers to attempts to put local matters ahead of global concerns. At one scale it can be addressed as nationalism eg "Put America First" or "Brexit". Nationalism is seen by governments as putting their national self-interests first. However, it is also associated with the rise of far-right political groups. The rise of the far-right in Europe has been linked to Islamophobia and anti-immigrant sympathies. The anti-immigration lobby was said to be a major reason for the UK voting to leave the EU, with the claim that the EU was determining migration policies rather than the UK deciding on its migration policy.

6.7 Areas close to Chernobyl had the greatest exposure and experienced the most hazardous conditions. Many firefighters were exposed to radioactive materials. People within 30 km of the reactor were evacuated and relocated. The soil and water in this area was contaminated and the topsoil was removed. People living downstream from Chernobyl on the Pripyat River were potentially exposed to radionuclides carried in the river. With increasing distance from Chernobyl, the hazard declined, although there was evidence of contaminated soil as far away as North Wales. However, the concentrations of radioactive materials were not considered to be unsafe.

6.8 Shipping is one of the least regulated sources of atmospheric pollution. It is a major contributor to sources of sulphur dioxide, oxides of nitrogen and $PM_{2.5}$ and PM_{10}. Shipping uses diesel fuel almost exclusively. On a global scale, shipping emissions account for less than 2% of total emissions. However, emission of black carbon from ships is a big issue. The climate impacts of short-lived black carbon are regional, with larger impacts nearer the areas of higher emissions. This is of special importance in the Arctic and other areas where there is snow/ice cover. In the UK, emissions of NO_x are predicted to rise by 2020, whereas emissions of sulfur dioxide are expected to fall, and emissions of particulate matter are predicted to be stable by 2020.

6.9 Importing food has transport costs (food miles). However, the production of imported food may have fewer alternative environmental costs, especially if the food is organic. Locally produced food may have costs related to fertilizers, pesticides, irrigation and greenhouse production, and these may add up to a greater environmental cost than that of the imported food.

6.10 A number of companies reduce their pollution at home by moving production to poorer countries with less environmental regulation. For example, the goods imported by US manufacturing firms rose from 7% in 1992 to 35% in 2016. During this time, the amount of pollution by US manufacturing fell by over 50%. It is not just HICs that are offshoring their polluting industries overseas. China's Hebei Iron and Steel Company announced plans to relocate steel, cement and glass production to parts of Africa, Eastern Europe, Latin America and other parts of Asia.

6.11 Survival International is an international civil society organization that focuses on the plight of indigenous groups, such as Australia's Aboriginal populations. They have provided funds for "homeland" projects whereby Aboriginal people leave towns and return to their ancestral lands. They support them to achieve "native title" to lands in the courts and in parliament. They also raise awareness of the issues through their website and through various publications, such as "Progress can kill".

However, their success has been limited. Many Aboriginal people have poor living conditions with high infant mortality rates, high suicide rates and lower life expectancy than the rest of the Australian population. They also make up a disproportionate amount of the prison population. Aboriginal people also experience social issues such as poor diet and alcohol and drug abuse.

6.12 Reshoring enables companies to work in the same time zone as their head office, speak the same language and reduce problems associated with currency exchanges, import duties and transport costs. It also reduces the time to get goods to customers.

6.13 **(a)** The main advantage of cybersecurity is the ability to protect information systems from threats such as theft and damage. This is becoming increasingly important as more and more people and organizations rely on computers and the internet. There are many threats to computer security. One of the most common is "phishing"—the attempt to obtain personal or sensitive information such as user names, passwords, bank account details and credit card details. Increased cybersecurity helps to protect this sensitive information.

A disadvantage is that there are no international regulations or common rules to abide by. Moreover, national security may be vulnerable to attacks from another country, making any international treaty difficult to regulate and enforce.

(b) An e-passport has a computer chip in it, which contains data about the owner. The advantages of the e-passport include faster checking in and border clearance. E-passports may also help in crime detection as some contain biometrics such as fingerprints, which may be left at the site of a crime. In addition, if someone loses their passport, the documents should be retrievable from a database and allow travel. E-passports are difficult to reproduce or forge, so security is improved. They also make it more difficult for one person to have more than one passport (unless they have dual citizenship).

E-passports also have a number of disadvantages. If the passport is stolen, the data could be used illegally. It could be possible for someone to hack into the system and change the data. Moreover, the person who owns the passport does not have access to the data.

IB Prepared Geography

Answers to practice exam papers

Here are the answers to the practice exam papers from *IB Prepared Geography*.

For direct access, click on the paper or subsection below.

Paper 1: Geographic themes

Option A: Freshwater

1. (a) According to the scale, 100 miles is equivalent to 1.5 cm on the map, and 200 km is equivalent to 2 cm. The maximum width of the drainage basin is approximately 1.5 cm on the page, and therefore answers of 80–120 miles, or 130–170 km will be accepted.

Some students may interpret the maximum width to be what is the maximum length of the basin; in this case, a mark should still be awarded (maximum length is approximately 550–590 miles, or 830–870 km).

In actuality, the maximum length and width of the Lake Ontario basin are 193 miles (311 km) and 53 miles (85 km) respectively. However, marks will only be awarded for using the map to determine the width of the basin.

(b) Water enters (or leaves) the Lake Ontario drainage basin from the St. Lawrence River drainage basin.

(c) A range of different factors can be discussed for spatial and temporal factors. One mark is awarded for stating the factor, and a further development mark is awarded for stating why this would mean an increase or decrease in erosion by a river.

An example for a spatial factor is below:

The process of erosion can increase when there is a higher velocity in a river, such as when a river is wider and deeper. The lower course of a river will have a greater cross-sectional area, meaning that there is more volume of water, which will mean a faster velocity and greater erosional power.

An example of a temporal factor is below:

When snow and ice melts in a drainage basin, for example, during spring months, this adds greater volume to a river and hence the discharge increases, and the river has greater power to be able to erode material from the river banks, for example, via hydraulic action.

(d) Four distinct points should be made which relate to the following aspects of wetlands:

- carbon sink;
- water filtration;
- safeguard the livelihoods of communities living in wetlands and conserve their traditions;
- protect coastlines from climatic hazards such as cyclones;
- employment and revenue such as fisheries or tourism;
- reduce erosion.

Other benefits are also valid.

2. There are several human influences that can be discussed in this response which may cause a range of changes downstream connected with the quantity and quality of water. These factors include:

- deforestation/afforestation/reforestation;
- channel management and modification;
- water withdrawal;
- the construction of dams;
- water sharing agreements;
- urbanization;
- agricultural activities;
- other sources of water pollution.

Other factors can be credited also.

If the effects from global climate change are discussed, then the maximum mark is four since the question refers to one part of a drainage basin rather than the macro effects from increased or decreased rainfall due to global climate change. Drainage basins can be compared and contrasted, and a range of different causes and effects will enable candidates to reach the higher mark bands.

Good answers may be **well-structured** (AO4) and include different perspectives regarding the positive and negative impacts from different causes with knowledge and understanding evident about the **processes** involved. **Evaluation** (AO3) is possible by recognizing that human factors alone do not ensure that change takes place since physical factors will also contribute, such as a period of prolonged heavy rainfall in an area which increases discharge and perhaps subsequent pollution downstream. Additional connection to overarching concepts can be made in terms of the negative and positive **possibilities** from the human factors upstream whilst the **spatial interaction** should be evident, such as change from the upper course to the lower course of the river.

Annotated diagrams and sketch maps would be appropriate for this question, such as the effect upon landforms, for example.

For **5–6 marks**, expect some relevant human factors, but examples are generalized and there are limited consequences.

For **7–8 marks**, expect a well-structured account which includes:
- either detailed case studies with the application of more than one human influence;
- or an ongoing evaluation linked to the geographical concepts and/or perspectives.

For **9–10 marks**, expect both of these traits.

3. An integrated basin management plan should be elaborated on in the introduction and the case study to be discussed stated. A definition for an IBDM should be close to the following: "a comprehensive approach to the planning and management of a drainage basin involving a variety of different stakeholders in order that there is a balance between economic development and environmental impact".

As the command term is "examine", responses should consider an argument or concept in a way that uncovers the assumptions and interrelationships of the issue. This means that they could show that a plan can be important for a number of places involved although some places receive more benefit than others.

One case study will have been studied for this section of the syllabus and depending on the drainage basin, there may be a national or regional scale discussed. Example basins could include the Murray-Darling, the Mekong, the Rhine, and the Senegal.

The importance can be qualified by explaining the economic, social and environmental consequences of the plan such as, but not exclusive, to the following:
- A greater provision of water from some parts of the basin may allow farmers to boost their agricultural yield in areas that previously experienced physical or economic water scarcity.
- Agriculture could be negatively affected due to the construction of dams upstream, which will reduce the quantity of silt and water reaching areas downstream thus reducing the agricultural yield for some areas.
- Increased irrigation projects upstream will add more salt to a river further downstream, which will increase salinity in an area that may rely on the use of water for agriculture.
- Energy production for some places within the basin plan could be environmentally friendly compared to other methods of energy production, such as the generation of hydroelectric power.
- The migratory pattern of fish could be disrupted with the building of dams upstream.
- The reduction of flooding.

Responses will reach the higher mark bands with place-specific detail and will be **well-structured** (AO4) and examine the positive and negative impacts of a plan, thus offering **critical evaluation** (AO3). The consultation and inclusion of different stakeholders provides an opportunity for analysing the **power** of a range of stakeholders within a drainage basin and responses can examine the extent to which all groups are consulted within the formation of plans.

For **5–6 marks**, expect some weakly evidenced examples about the importance of the plan.

For **7–8 marks**, expect a well-structured account which includes:

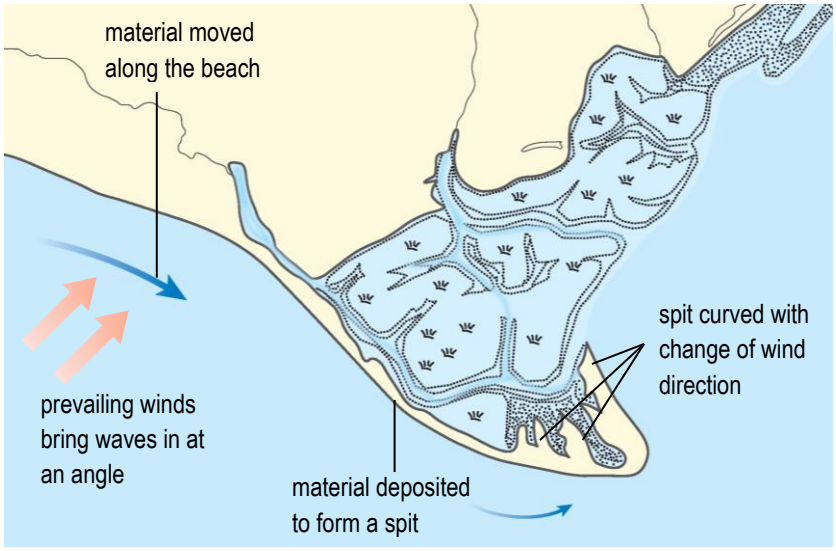
- either a well-evidenced explanation about the costs and benefits from a plan;
- or a range of perspectives grounded in geographical concepts about the role of different stakeholders.

For **9–10 marks**, expect both of these traits.

Option B: Oceans

4. (a) Spit; beach.

(b)



(c) The image can serve as inspiration for the response but this question is open-ended and a range of different land-uses are appropriate. One mark for stating a valid effect and one mark for development. Maximum two marks if only one land-use is explored. For example:

Urbanization: The construction of residential areas on a cliff line may result in the collapse and slumping of the cliff due to the additional weight or load that the underlying has to bear.

Tourism: The development of facilities for tourists may lead to an increase of people on beaches which may then result in litter pollution on beaches as well as water pollution.

Trade: The creation or expansion of a port may result in shipping increasing in an area, which may result in water pollution which then has a detrimental impact upon marine ecosystems.

Other land uses are valid.

5. The response can focus on coastlines, coral reefs, and wetlands, such as mangrove swamps, and these should be identified when defining coastal margins. The command term is "examine" and there should be different perspectives from stakeholders in terms of how they value coastal margins. Stakeholders can include local and national governments, industry such as fishing or tourism, environmental organizations, tourists, and others.

Good answers will be **well-structured** (AO4) and will explain the views of different stakeholders using a range of **places**, and **critical evaluation** (AO3) would be expected by discussing the viewpoints of different stakeholders. Temporal change can be included due to the dynamic **processes** affecting coastal margins, such as the growth in tourism due to the growth of the global middle-class or the increasing threats from global climate change.

For **5–6 marks**, there will be some weakly evidenced discussion about the economic and ecological value, although there will be a lack of depth.

For **7–8 marks**, expect a well-structured account which includes:

- either detailed examples from more than one place with both the economic and ecological value discussed;
- or a discursive conclusion that discusses the perspectives of different stakeholders involved.

For **9–10 marks**, expect both of these traits.

6. The guide requires the study of pollution from radioactive materials, oil and plastic waste, and the question requires more than one initiative. It is expected that the strengths and weaknesses of at least two of the three are discussed.

Initiatives could include:

- SDG links such as SDG 14 which includes various targets such as reducing coastal eutrophication and floating plastic debris density;
- campaigns by environmental groups to educate people about the problems connected with waste disposal can stem the issue from the source;
- a clean-up of plastic in the Pacific Ocean via a system that aims to collect 40,000 metric tons of plastic by 2023.

Those responses reaching the higher mark bands will be **well-structured** (AO4) discuss examples at different **scales,** and the presence of scale may be discussed as a reason for success or not for the initiative. The concept of **power** could also be addressed if national or multi-governmental initiatives are discussed. **Critical evaluation** (AO3) is necessary to reach the higher mark bands. For example, after the 2011 Fukushima Daiichi disaster, radioactive waste was still entering the Pacific Ocean despite measures being implemented or alternatively, the plastic removal from the Pacific Ocean does not collect microplastics. The **possibilities** include positive change being challenged due to the rise of the global middle class and consumerism which can generate more waste in ocean water, or the detrimental effect of acidification from anthropogenic climate change.

For **5–6 marks**, examples are included but are limited in detail, with some strategies discussed.

For **7–8 marks**, expect a well-structured account which includes:

- either a detailed explanation about two efforts designed to manage ocean pollution;
- or expect ongoing evaluation grounded in the geographical concepts and/or perspectives.

For **9–10 marks**, expect both of these traits.

Option C: Extreme environments

7. (a) Two points should be made from the following list.

- Semi-arid areas can be found along similar lines of latitude.
- Semi-arid areas can be found in all continents.
- There is a linear pattern in Africa to the south of the Sahara desert and across central Asia
- West coasts of India and South America and parts of the American and Mexican west coast contain semi-arid areas.

There is no credit for suggesting an anomaly.

(b) 1 mark for each valid point and 1 mark for development.

Valid points include:

Cold environments: For example, building settlements on stilts is necessary due to the thawing of an upper layer of permafrost causing instability in the ground, or a short agricultural season when arable farming is possible raises issues of food security, especially when a place is devoid of animals to hunt, or the difficulties in constructing infrastructure due to the frozen ground. Places in Siberia would be appropriate examples.

Hot environments: For example, human discomfort such as heat stroke or heat exhaustion which reduces productivity and an ability to generate income when working in agriculture, and could result in living below the poverty line. Places such as Gujarat in India would be appropriate.

(c) 1 mark for a valid point and 1 mark for development which could include examples also.

Possible answers include:

Agriculture: Specific techniques can be used in dryland farming, such as crop rotations to enhance diversity, ensuring that soil is covered with crops being grown which also provides nutrients to the soil, ensuring that pastoral farming is integrated into the growing of crops.

Tourism: Destinations in deserts can attract many tourists who wish to go trekking, on vehicle safaris using all-terrain vehicles, camel riding or staying at resorts in an oasis.

8. Responses should ensure that the interrelationship is discussed, namely that global climate change and extreme environments influence each other. It is expected that contrasting extreme environments are examined and that a range of effects are explained.

Global climate change is altering the climatic conditions such that a temperature increase will cause cold environments to become more habitable whilst places that already experience extreme heat will become less hospitable. It is predicted that some places will become too hot for human habitation if trends continue.

The changes taking place in some ecosystems will create a positive feedback loop with additional greenhouse gases added to the atmosphere, such as the release of methane when permafrost melts and exposes the ground underneath. This will cause a further temperature increase and more permafrost to melt. In addition, the reduction in albedo as ice melts will ensure that more heat is absorbed thus further increasing temperatures.

An alternative perspective will be expected for higher marks bands since this is expected from the command term “discuss” and represents **critical evaluation** (AO3). For example, the human **processes** involving modifications to extreme environments can have a mitigating effect upon global climate change, such as the establishment of vegetation in an arid environment thus ensuring that water is retained, soils improved, and the albedo is not reduced or the generation of solar power. Different **scales** can be examined as part of the response and answers that are **well-structured** (AO4) will reach the higher mark bands.

For **5–6 marks**, expect contrasting extreme environments that contain limited detail and some description about the interrelationship, but a lack of explanation.

For **7–8 marks**, expect a well-structured account which includes:
- either detailed explanation for contrasting extreme environments with the interrelationship substantiated;
- or there is an ongoing evaluation present of how human processes can have a positive or negative impact upon global climate change which is grounded in the geographical concepts and/or perspectives.

For **9–10 marks**, expect both of these traits.

9. A popular choice would be the example of Standing Rock in North Dakota, USA, where plans to pipe 470,000 barrels of oil to a refinery in Illinois have proved very controversial, although a range of other examples would be applicable. The question requires more than one group to be discussed and the syllabus requires indigenous groups, civil society organizations, TNCs and militia groups to be studied. There should therefore be many opportunities in which to show detailed knowledge in relation to the conflict. Application is possible by comparing and contrasting the views of the different stakeholders.

The stakeholders involved in Standing Rock are as follows:
- Energy Transfer Partners—this corporation is in charge of the project to build the Dakota Access pipeline. They obviously are in favour of the project and state that the pipeline is a safe method of transporting the oil.
- The Sioux tribe that is local to the area—their view is that the project contravenes federal law (National Historic Preservation Act) and the agreements that have been made between Native American tribes and the government.
- The US national government who gave approval for the project.
- Individuals in society—many concerned individuals have visited the site to protest about the project alongside local people.
- The US Army Corp of Engineers—some of the camps set up by protestors are based on the Army Corp's land.

Good answers may be **well-structured** (AO4) and include **synthesis** (AO3) which should include a substantiated conclusion in which the range of different viewpoints are discussed. This will involve the **power** of different groups and individuals and some of these may have influence at different **scales**, for an example a national government or a multi-national environmental organization. Temporal change will also enable students to reach the higher mark bands as the views of particularly political actors in the conflict can change over time.

For **5–6 marks**, different stakeholders are discussed but there is limited detail regarding their viewpoints.

For **7–8 marks**, expect a well-structured account which includes:
- either a detailed explanation about the different groups and individuals involved;
- or a discursive conclusion (or ongoing evaluation) about how power and influence of different stakeholders can change over time.

For **9–10 marks**, expect both of these traits.

Option D: Geophysical hazards

10. (a) Any of the following is acceptable with 1 mark allocated for map evidence (area, distance, direction):
- the coastline of the bay (10 km);
- moving north-west from the bay's coastline;
- an anomaly to the east of the bay along the coastline.

(b) Possible answers include:

- There are shallow foundations, therefore the building on the surface will become unstable and sway leading to collapse;
- There is no steel framework which can be both flexible and strong to absorb the energy, while not allowing the collapse of a structure;
- The place looks to be abandoned and is therefore not being maintained or protected in an area that is perhaps susceptible to earthquakes.

Stating simply that an earthquake occurred will receive no credit.

(c) For earthquakes, the Richter scale is the most well-known measurement scale. A strength of the Richter Scale in terms of risk management is that past records of earthquakes can be observed in order to detect a pattern over time. Another strength is that the recording of seismic energy can provide an indication for a possible tsunami. An early warning system will provide additional information regarding the real threat from a tsunami, but the measurement of the initial earthquake will help places to respond.

A weakness of the Richter scale is that scale measures the energy released from the seismic waves but not the actual strength and subsequent damage that can be caused in an area. So when assessing risk, it may not be known what impact a 7.0 earthquake may have on a place. In addition, the seismometer may only measure the earthquake close to its epicentre or focus, but the risk to be managed could be in a place some distance away. Therefore there could be a higher risk if an earthquake's epicentre is much closer to a place.

An alternative measurement tool, the Mercalli scale, could also be discussed for this question.

Explaining that other variables are important will not receive any credit since the method of measurement must be analysed solely.

11. Geophysical hazard risk can be determined by a range of economic and social factors and the response should discuss some of these. Depending on the case studies included, candidates can argue that economic factors are more important at reducing risk or vice versa. Other factors (eg political) could also be examined and this would provide an opportunity for evaluation, as well as analysing different viewpoints for economic and social development factors.

In terms of higher economic development, some of the following factors can be discussed:

- There is funding for technology to be able to monitor and predict geophysical hazard events.
- Emergency services receive government revenues or there are private companies operating rescue and response teams that can reach areas at risk quickly and transport the injured to hospitals.
- Slopes can stabilized via expensive infrastructure such as pipelines and steel rods.

For social development factors, some of the following factors in places can be discussed:

- the quality of education in terms of how to react when an earthquake takes place via evacuation drills, and ensuring that people have a survival kit with essential items;
- the level of gender equality to ensure that females are not at a greater risk than men (such as the Indian Ocean tsunami in 2005);
- the quality of healthcare and speed of response to those injured in a hazard event;
- the level of expertise and knowledge to be able to predict, monitor and advise populations on the risk of a hazard event taking place.

Other factors, including political reasons, can also be discussed such as:

- Strict building regulations can be imposed which ensures that buildings meet a certain standard and will not collapse.
- Land-use planning will prevent people living and working in areas that could be at risk from mass movement or pyroclastic/lava flows and lahars.

There are a range of examples that can be included for volcanic eruptions, earthquakes and mass movement at different levels of economic development. Contrasting **places** should be discussed and the **power** of government intervention will provide an opportunity for **critical evaluation** (AO3) within a **well-structured** response (AO4) to reach the higher mark bands. Alternatively, the possibility of accessing external help via NGOs and multi-governmental organizations or other governments may help reduce the need for national development. For example, NOAA's Pacific Tsunami Warning Centre provides interim tsunami warnings to countries bordering the South China Sea (China, Philippines, Malaysia, Brunei, Indonesia, Singapore, Thailand, Cambodia, Vietnam).

For **5–6 marks**, expect a relevant example for both economic and social development although a limited level of detail.

For **7–8 marks**, expect a well-structured account which includes:

- either detail explanations for economic and social factors;
- or the inclusion of other factors such as political impacts which are grounded in geographical concepts and/or perspectives.

For **9–10 marks**, expect both of these traits.

12. The question provides a foundation for discussing volcanoes, earthquakes or mass movement and therefore a range of different examples are appropriate. The introduction should define key terms such what constitutes a pre-event strategy. The question states "places" and so more than one case study should be discussed. This would be necessary in order to reach the higher mark bands. The syllabus requires two case studies for mass movement, volcanic eruptions and earthquakes so candidates should have sufficient knowledge.

Possible examples include Chile, which has implemented strict construction regulations to prevent buildings from collapsing, and Mexico City, which has seen older buildings (built before the introduction of construction codes) collapse. In terms of mass movement, the evacuation of people from areas susceptible to landslides has been successful in some places and this has been possible due to the monitoring of slopes and weather conditions. More rapid mass movements are more difficult to predict, however. It is a great challenge for places to predict events and implement pre-event strategies, especially in areas with no documented history of hazard events.

Good answers may be **well-structured** (AO4) and include **critical evaluation** (AO3) in which the characteristics of **places** are discussed. The negative and positive possibilities will provide opportunities for **critical evaluation** (AO3); for example, some places have experienced negative consequences, despite having pre-event strategies. This ensures that evaluation is possible.

For **5–6 marks**, expect some relevant but limited evidence for examples, although one of these examples will be more limited in terms of detail and only one type of geophysical hazard is discussed.

For **7–8 marks**, expect a well-structured account which includes:

- either a well-evidenced explanation for more than one hazard event;
- or there is ongoing evaluation present grounded in geographic concepts about the characteristics of different places and how these contribute to the success of pre-event strategies.

For **9–10 marks**, expect both of these traits.

Option E: Leisure, sport and tourism

13. (a) (i) Don Muang (overcapacity by 16.7 million passengers)

(ii) Krabi (overcapacity by 1.1 million passengers)

(b) 1 mark for a valid and realistic suggestion and 1 mark for development that states how congestion can be reduced. Possible examples include:

- Tourists could have to apply for a permit to visit during certain days of the week or certain months of the year. The expense and time taken may stop some from visiting the city.
- Tourists could only be allowed visit in organized groups, which allows the city authorities to monitor the number of tourists visiting an area during a time period.
- There could be investment in alternative attractions or promotion of existing attractions, in order to relieve the pressure on existing places whilst maintaining and perhaps increasing tourism revenue.
- Increased policing, city employees or the use of CCTV in order to maintain order and reduce numbers in a particular area.

(c) Economic, social and environmental benefits can be included. 1 mark for each valid point and 1 mark for development. There are a range of appropriate examples, including those outlined below.

Economic benefits include:

- ensuring that local businesses generate direct and indirect employment;
- tax revenue for the government based on the local businesses that have been created;
- no leakage since tourism businesses are owned by nationals.

Social benefits include:

- The tax revenue can be used by the government for investment in public services such as healthcare, which increases life expectancy, or towards schools, which improves the level of education.
- Local people who have acquired jobs or opened businesses will experience a higher quality of living with increased disposable income to improve their diets, for example.

Environmental benefits include:

- Tourism facilities can be constructed according to regulations that are designed to protect the natural environment (ie ecotourism).
- Tourism with an emphasis on natural attractions ensures that these environments within the sustainable tourism destination are protected.

14. The final part of this theme concerns the analysis of gender inclusion programmes, the importance of the Paralympics and the inclusion of more countries participating in events. Social movements can be defined and an example can be included, while political involvement can be discussed at local, national and multi-governmental levels.

Female participation can be discussed in term of political decisions to allow females to take part in sports that were traditionally for men only. In the UK, the campaign group “Women in Sport” has featured many high-profile initiatives to increase participation in different sports as well as the presence of females on sporting bodies. The United Nations and the International Olympic Committee have taken steps to increase female participation in future Olympic Games.

The number of athletes taking part in the Paralympic Games has increased over the recent decade, with viewing figures for television audiences increasing. Traditionally, athletes that took part in the Games came from European and North American countries, but the 2018 Winter Games in PyeongChang, South Korea, featured North Korea, Tajikistan and Georgia for the first time.

Good answers may be **well-structured** (AO4) and may also offer **critical evaluation** (AO3) by discussing how political factors and social movements can widen or restrict participation, thus restricting **possibilities**. For example, sanctions can be applied by governing bodies, such as the IOC banning Russian athletes in the Rio 2016 Olympic Games due to them taking illegal performance enhancing drugs at previous international sporting events.

Political conflict within a country or between countries may mean that countries do not take part in sporting events. For example, Syria sent a delegation of athletes to complete in Rio but prohibited any athletes that came from rebel-held areas.

For **5–6 marks**, there will be some limited examples for both social movements and politics about either increasing or decreasing inclusivity.

For **7–8 marks**, expect a well-structured account which includes:

- either detailed explanations about the factors that increase or decrease participation;
- or there is an ongoing evaluation that relates to geographical concepts such as the power and scale of decision-makers (eg international bodies, national governments).

For **9–10 marks**, expect both of these traits.

15. The term, "primary touristic resources" should be defined in the introduction; it refers to the human and physical resources that attract people to visit a place. The term, "tourism hotspot" should also be defined (a place or an attraction that receives a high level of visitor interest). It is important to note that the question does not ask solely for urban or rural hotspots, both of which should have been studied, and responses can explain the growth of both.

Urban tourism hotspots can be those with historical architecture, such as the European cities Berlin, Vienna and Barcelona. Within these places, there are certain attractions that tend to attract a significant amount of tourists, such as Sagrada Família in Barcelona. Rural tourism hotspots would be places, for example, that tend to have unique scenic beauty. A range of different factors can be included to show knowledge.

Good answers may be **well-structured** (AO4) and may also offer **critical evaluation** (AO3) by discussing how secondary touristic factors are important in bringing tourists to a place. The development of public transportation to a place via a park-and-ride scheme, for example, may enable places to receive a large number of tourists as congestion is reduced. It may connect with other public transportation, therefore allowing people to travel if they do not have a private vehicle. The combination of primary and secondary touristic attractions gives a **place** its unique characteristics. Temporal change in terms of a decrease in growth can also be discussed at this level by examining how an urban or rural hotspot may only receive a significant number of tourists at certain times of the year. This can be due to a range of factors, such as traditional holiday/vacation times or climate conditions decreasing the level of comfort in a destination.

For **5–6 marks**, there will be some limited examples of tourism hotspots and reasons for their growth.

For **7–8 marks**, expect a well-structured account which includes:

- either detailed explanations about the primary touristic factors that have increased the number of tourists visiting a place;
- or an ongoing evaluation that discusses the importance of secondary touristic resources enabling the growth of tourists to a place or changes in growth over time.

For **9–10 marks**, expect both of these traits.

Option F: Food and health

16. (a) 1 mark each for two of the following factors:

Urbanization; economic growth increased consumerism; growth of the middle-class; technological changes for work; leisure and good processing; mass media growth and advertising of products; increasing availability/cheap cost of fast food.

(b) It represents a change when a population goes from experiencing high rates of infant mortality (for example, due to famine) to deaths being caused by human-made and degenerative diseases.

(c) Three separate points with development are required to achieve full marks. Some examples are given below; other advantages are valid.

- Genetically modified organisms (GMOs)—resistance to viruses and pests ensures that agricultural yields are maintained.
- Vertical farming—as crops are grown inside buildings, the climate can be controlled such that crops are not affected by any extreme change in climate and more food can be grown per acre of land.
- In vitro meat—can be designed in order to be disease-resistant to prevent diseases such as swine flu to spread to human populations.

17. Water-borne and vector-borne diseases (for example, malaria, dengue, yellow fever) should be defined in the introduction as well as the possible geographic factors to be discussed in the essay. The scale of diffusion should be stated and higher marks are scored depending on the level of detail for both examples.

Geographic factors that can be discussed are:

- the level of sanitation;
- the movement of people via increased international trade and travel;
- the lack of healthcare available to people;
- a lack of knowledge regarding the disease;
- climatic factors;
- changing land use.

Better responses will be **well-structured** (AO4), include **critical evaluation** (AO3) about the impact of different human and physical factors that have led to the diffusion of both categories of disease, and/or compare and contrast the diffusion. By discussing these processes, better responses should also examine the **spatial interaction** between **places** as well as explain the how the characteristics of **places** affect the diffusion.

For **5–6 marks**, expect some limited evidence for both diseases which is mainly descriptive with minimal explanation which links the diffusion to the geographic factors.

For **7–8 marks**, expect a well-structured account which includes:

- either a well-evidenced explanation for the diffusion of both diseases in relation to geographic factors;
- or there is an ongoing evaluation that is grounded in geographical concepts and/or perspectives.

For **9–10 marks**, expect both.

18. Famine should be defined in the introduction (there are a range of definitions but an accepted one is a prolonged period without food which causes higher than normal mortality due to disease and under-nutrition). A range of factors should have been studied such as international aid, governance and the role of the media. Factors could involve proactive and reactive measures.

In terms of international aid, candidates can explain that emergency food aid can ensure that lives are saved, although they can also recognize that the dumping of food can ensure that local farmers are not able to sell their crops, potentially creating poverty. In other words, people receive nutrition but other parts of the community suffer economic hardship, perhaps leading to food insecurity. It is expected that the role of other governments via bilateral aid will be discussed, or multilateral aid through organizations such as the FAO.

Effective governance refers to the ability of a government to ensure that a famine is not unexpected, and that there are provisions implemented such that places are able to cope with a lack of food (for example, the storage of food). A stable government will be able to fund research into improving agricultural yields and ensuring that fertilizer is made available, or constructing a road network to enable to movement of aid, if it is needed. Alternatively, internal and external conflict in a country can disable the possibility of finding safe routes for emergency aid to reach a place, while corruption can prevent aid from reaching those that need it.

The media's involvement in highlighting famine can raise awareness across the world which can then increase the amount of funding needed for emergency aid to reach a place. With ever increasing natural disasters taking place as a result of global climate change, candidates could argue that donor fatigue will result in less charitable donations from places.

Better responses will be **well-structured** (AO4) and may include **critical evaluation** (AO3) by examining the success, or lack of success, of different strategies to reduce famine. For **synthesis** (AO3), a clear conclusion can address the complex issues of famine and the need for a range of **possibilities** to help improve the situation in **places**.

For **5–6 marks**, expect some geographic factors are described but a limited application to the question, and examples will be somewhat generalized.

For **7–8 marks**, expect a well-structured account which includes:
- either detailed evidence which explains a range of strategies;
- or there is an ongoing evaluation based on the geographical concepts and/or perspectives.

For **9–10 marks**, expect both of these traits.

Option G: Urban environments

19. (a) 2 marks for a valid point with development.

For example, the total cost can be discussed with both countries having one city that has significantly more economic costs due to congestion than the other high-ranking cities in each respective country. New York has a $14.5 billion difference to the second ranking city whilst London has a $12 billion difference. Alternatively, the total cost to the top 5 cities in Britain is less 50% of the cost to Los Angeles in 2017 ($13.66 billion compared to $33.7 billion).

(b) Two separate points are required to get full marks and the following strategies are valid:
- investment in public transport to make it more available and accessible;
- investment in public transport to subsidize the cost and make it more affordable and more accessible;
- creating cycle lines;
- encouraging car-pooling through incentives;
- creating park and ride schemes.

Other valid points will also receive credit.

(c) Green space could be depleted due to a range of reasons depending on the example chosen but some of the following reasons would be appropriate:
- the construction of housing in order to accommodate a rising population due to in-migration or rising fertility rates, for example;
- the creation of leisure facilities by converting the green space in facilities, such as golf courses;
- the expansion of transportation infrastructure to accommodate more private vehicles or public transportation networks;
- A lack of investment in the green spaces may mean that they become neglected and not hold much value in a neighbourhood, making them more susceptible to redevelopment

A maximum of 2 marks is awarded if no example is provided and relevant point(s) are made. The development must be specific to the neighbourhood, town or city in order to be credited with the third and fourth marks for development.

20. The introduction should define the urban ecological footprint (UEF), which is "the theoretical measurement of the amount of land and water that an urban population requires to produce the resources it consumes and to absorb its waste under prevailing technology". Candidates may also show knowledge about a linear or a circular system for an urban environment and refer to the latter as a way in which urban areas can recycle waste.

Eco-city design can include a range of different strategies that are used at different **scales** within an urban environment (urban environments have varying sizes in terms of area and population) such as a single-building development to a neighbourhood or a city-wide scheme. Each strategy should be directly linked to an aspect of the urban ecological footprint.

Examples of **possibilities** for reducing the UEF include:

- individual buildings such as the Bosco Verticale in Milan, which has been designed to include vegetation for each apartment;
- neighbourhood initiatives such as the Cary Green Neighborhood Project (CGNP), which took place in 2017 that involved a range of stakeholders in a project aimed at environmental sustainability.
- city-wide programmes such as the pedestrianization of cities (for example, Frieburg, Germany) or the implementation of green energy production such as Quelimane, Mozambique, where all energy comes from hydroelectric power;
- a wide range of initiatives that have been implemented to meet the various targets for SDG 11 (Sustainable cities and communities). In addition, other SDGs can be connected to reducing the UEF.

Well-structured (AO4) answers will reach the top mark band. **Critical evaluation** (AO3) may recognize that, while these **possibilities** are taking place, there are many cities in the world that are growing with limited initiatives in place to reduce the UEF. This is especially the case with a growing middle-class and increased consumerism, with an increased production of waste. Therefore different cities or **places** in countries at different levels of development may not necessarily have the same priorities regarding the UEF. Examples at a single-building level can be recognized as only having a minimal effect on the UEF. It can also be argued that the production of energy from renewables may still contribute waste in the form of emissions; for example, during the production process of the products, or the building of dams using concrete.

For **5–6 marks**, expect some weakly evidenced examples of some cities that have implemented initiatives, with there is a lack of explanation in connecting with the UEF.

For **7–8 marks**, expect a well-structured account which includes:

- either a well-evidenced explanation of initiatives that have been implemented;
- or offers an on-going evaluation that is grounded in geographical concepts and/or perspectives.

For **9–10 marks**, expect both of these traits.

21. The statement provides a foundation for evaluation; yes, it can create deprivation due to the loss of employment, for example, or no, it can provide an opportunity for regeneration. Alternatively both can be discussed and those responses that address both the positive and negative consequences will reach the higher mark bands. “Deindustrialization” is a term that is expected to be defined in the introduction and will be indicative of the candidate’s knowledge of this process.

It is expected that different **places** are discussed when addressing the costs and benefits. The costs could include:

- a loss of income leading to a lower quality of life by having to survive on a lower income while possibly supporting a family;
- a lack of other suitable employment in the local area, therefore no long term prospects of attaining a new job unless there are retraining possibilities.

The benefits may include:

- urban regeneration could take place with investment coming from a city or national government, or perhaps a multi-governmental organization such as the European Union, to help alleviate the expected deprivation from the loss of industry and employment;
- new housing can be developed in an area, such as loft apartments in old textile mills thus ensuring that greenfield sites are not built upon;
- the area may also be turned into a green space, replacing industry that may have added pollution to a city, and instead the area could reduce environmental and social stress.

Good answers will be **well-structured** (AO4) and may include **critical evaluation** (AO3) about the **possibilities** that result from deindustrialization. The **power** of public and/or private funding can be examined, and a contrast between **places** is possible with the roles of different stakeholders.

For **5–6 marks**, expect examples that contains some costs and benefits although one perspective will be very limited in terms of detail.

For **7–8 marks**, expect a well-structured account which includes:

- either a well-evidenced account which includes a detailed explanation for more than one example of deindustrialization;
- or there is an ongoing evaluation grounded in geographical concepts and/or perspectives.

For **9–10 marks**, expect both of these traits.

Paper 2: Geographic perspectives — global change

Part A

Unit 1: Changing population

1. (a) Three distinct points should be included in the description, and data is required in order to receive the full 3 marks. If there is no data, then a maximum of 2 marks should be awarded. Points could include the following.

- Most of the population tends to live in the south-west of the country with the majority of the country sparsely populated.
- The area with the highest population density is in the south-west with over 95 people per square kilometre, and the area with the lowest population density is in the furthest north and furthest south of the country, with both areas having less than five people per square kilometre.
- A possible anomaly would be the southern area that borders Yemen with the lowest population density (less than 5 people per square kilometre) even though it is close to areas with the highest population densities (over 95 people per square kilometre). It does not follow the "distance decay" pattern that other parts of the country experience which is a gradual decline in the amount of people per square kilometre.
- The population distribution is uneven.

(b) 1 mark for stating the reason and then one mark for development.

A range of physical reasons could be given connected to migration such as:

- Dry conditions and a lack of rainfall/surface water in the west of the country make living there very challenging, since it is difficult to farm or establish settlements.
- Steep relief may make it difficult to construct infrastructure, therefore making it difficult to establish businesses or settlements which would be very isolated.

Other answers are valid also and students may refer to specific country knowledge in their answer.

(c) 1 mark is for naming a valid megacity. If no valid megacity is named or it is left blank, then a maximum of 4 marks should be awarded. For each of the two reasons, development is required for the additional mark. Possible megacities include Shanghai, New York City, Mumbai to name but some. The growth can refer to an increase in the amount of people and/or an increase to the built environment/physical size of the megacity.

Possible reasons include:

- There could be new government policies and increased investment to create the conditions for economic growth and industrialization, such as the creation of free trade zones close to a megacity. People will move to the city in order to find employment in these areas.
- Foreign Direct Investment (FDI) could take place due to government policies easing restrictions for businesses, which will also create further opportunities for employment and therefore people will move to these areas.
- The development of infrastructure will further encourage FDI in megacities, as the imports and exports can be more efficiently transported in and out of the city to other parts of the country and/or region.
- Government policy may also enable people to live in megacities, such as the Hukou system in China, which boosts the population of cities such as Shanghai.
- People may move to megacities since they are perceived to be safer places to live. For example, migration from the north of Nigeria, where there has been internal conflict with Boko Haram, to cities in the south of the country.

- Health provision may be higher in megacities and people will move there for these and a better quality of life.
- There could be a wider choice of schools, which may offer more opportunities at primary, secondary and tertiary levels of education.
- There could be a lack of government policies such as planning regulations to prevent urban sprawl, or population policies to reduce natural increase.

Unit 2: Global climate—vulnerability and resilience

2. (a) (i) Accept between 8–12 billion metric tons.

(ii) China

(b) (i) A positive feedback loop will enhance or amplify a change that is taking place. This will create a domino effect that will eventually amplify or influence the first variable in the process.

(ii) 3 marks are available for explaining the process using any of the following:
- longwave radiation is absorbed by greenhouse gases causing the temperature to increase;
- ice melts therefore decreasing the albedo of a surface area;
- more short-wave radiation is absorbed because of the lowered albedo;
- the temperature increases and more ice melts.

(c) 2 marks for each effect, with the first mark for stating a valid consequence and the second mark for development via explanation.

Positive consequences include the economic and social benefits from agricultural change: due to an increase in global temperatures and more rainfall in some areas there would be longer growing seasons/more ability to farm (increased arable and pastoral land) in areas which previously had permafrost/be able to grow a wider variety of crops. 1 mark for any of these points.

The second mark would be for the explanation such as:
- increased revenue from commercial farming;
- greater food security so less stress and potential conflict for people living in an area;
- a better diet since greater access to food.

Other positive benefits are valid.

Negative consequences are more numerous such as the following:
- increase spread of disease causing premature death;
- sea-level rise due to melting glaciers and thermal expansion causing a loss of agriculture land and the destruction of property;
- flooding due to rising waters in rivers as glaciers melt and from more intense periods of rainfall. The flooding will cause a loss of agriculture land and the destruction of property;
- greater instances of drought causing agricultural production to decline and water scarcity increases leading to higher water charges in some places;
- mass migration due to areas becoming uninhabitable as temperatures reach a level where it is not possible to survive;
- unemployment as tourism suffers due to the destruction of natural land and seascapes;
- destruction of property due to an increased frequency and magnitude of cyclones.

There is a maximum of 2 marks if the effects do not explicitly connect to the impact upon peoples' lives.

Unit 3: Global resource consumption and security

3. (a) Asia Pacific

(b) A range of points can be made from any of the following:

- High-income regions such as Europe will see a decrease in their percentage of the world's middle-class population.
- Middle-income regions such as Asia-Pacific will see an increase in their percentage of the world's middle-class population.
- Low-income regions such as Sub-Saharan Africa will see no change or very limited change in their percentage of the world's middle-class population.

Quantification must be included to be credited with 3 marks.

(c) It is expected that answers will focus on two approaches to help achieve resource stewardship: a circular economy and the Sustainable Development Goals. 1 mark is awarded for each of the strategies stated.

2 marks are then awarded for the development of each strategy: 1 mark for explaining how resources can be conserved and a second mark for either further development or for stating an example.

For example, SDG 12 promotes sustainable consumption and production. This involves countries, at different levels of development, meeting a number of targets by 2030 or earlier. For example, one target is to reduce the amount of food waste from commercial food retailers by 50%, and another is to encourage higher national recycling rates in countries.

Part B

4. (a) (i) South America (15%)

(ii) Africa (4%)

(b) (i) 3 billion

(ii) 0.9 billion (900,000,000)

(c) There are a number of possibilities and three problems should be outlined with a suggestion for each in order to improve the infographic. Possibilities include:

Issue	Improvement
The bar chart on the right-hand side does not explain the difference between the coloured bars.	Label the bars to explain what each colour represents.
The pie charts that are located in Russia don't indicate whether these values represent Russia or Asia.	Reposition the pie charts so that it is clearer which area they are representing.
The pie charts appear to be the same size despite being labelled with different values.	Include proportional pie charts to represent the values so that the differences between continents would be more effectively displayed.
The figures that represent the amount of elderly people in 2050: the 2012 data states that it is "1 in 3" but it shows 1 in 4.	Remove one of the non-elderly stick figures so that it is more accurate. A third versus a quarter is a significant difference.

Part C

5. Managing populations refers to the implementation of policies that are designed to impact the birth and death rates in a country as well as controlling migration.

Possible applied themes (AO2) demonstrating knowledge and understanding (AO1):

- Responses could focus on the impact of pro and/or anti-natalist policies which will either attempt to increase or decrease the population of a place. If this place is susceptible to the negative impacts from global climate change such as sea-level rise and flooding, then there is the argument that potentially more people will be at risk if a place's population increases and vice-versa.
- Gender equality policies will decrease the risk facing females; for example, greater equality in terms of access to education will increase women's knowledge about the risks from disease.
- Policies connected with eradicating human trafficking will reduce the vulnerability of women and children, who may be at risk when a place experiences flooding.

Good answers may be **well-structured** (AO4) and may additionally offer a **critical evaluation** (AO3) which focuses on the **possibilities** for both increasing and decreasing the risk for a **place**. Responses could evaluate the relative importance of political decisions in relation to global climate change, which may be insufficient when large areas are at risk for land degradation or water scarcity. It could be argued that the impacts will be felt by people regardless of what demographic changes take place. Responses may refer to the **scale** of the negative impacts. In addition, other factors can be discussed as being more significant, such as the relationship between global economic development and resource stewardship in alleviating the negative impacts and risks associated with global climate change.

For 5–6 marks, expect weakly-evidenced outlining of policies relating to managing populations.

For 7–8 marks, expect a well-structured account which includes:

- either a well evidenced synthesis which links together several well-evidenced political policies from the subject guide;
- or a critical conclusion (or ongoing evaluation) informed by geographical concepts and/or perspectives.

For 9–10 marks, expect both traits.

6. It would be expected that responses will focus on economic development and the subsequent change in lifestyle. Resources to be discussed are water, food and energy, and responses may address the connections between these by referencing the nexus. The changing global picture of development should be discussed with the growth of emerging economies.

Possible applied themes (AO2) demonstrating knowledge and understanding (AO1):

- Responses could focus on the effects from changing diets due to the rise of the global middle class and an increase in food production due to demand. This can create issues such as water scarcity due to an increase in irrigation, which may deplete the amount of groundwater that is present in a place.
- Responses may examine the energy production in the production of goods as a country invests in manufacturing. This energy used may come from non-renewable sources.
- The use of strategies that are designed to conserve resources such as various Sustainable Development Goals, and the implementation of programs from the circular economy (such as leasing electrical equipment in order to prolong the life of products) may be examined.

Good answers may be **well-structured** (AO4) and may additionally offer a **critical evaluation** (AO3) which focuses on how development can take place in a sustainable manner. For example, the **processes** of generating energy by using renewable sources resource consumption are managed in a sustainable manner. The **power** of different stakeholders with the decision-making can influence the extent to which resources are depleted. For example, consumers opting to eat less meat which will reduce the amount of water used in food production.

The **spatial interaction** between places can be also be discussed as the economic development taking place in one country can be fueled by the resources from another country, for example. Responses may also refer to the temporal changes that can be caused due to the long-term damage that development can have upon a place.

For 5–6 marks, expect weakly-evidenced outlining of the relationship between global development and resource security.

For 7–8 marks, expect a well-structured account which includes:

- either a well evidenced synthesis which links together the water-food-energy nexus from the subject guide;
- or a critical conclusion (or ongoing evaluation) informed by geographical concepts and/or perspectives.

For 9–10 marks, expect both traits.

Paper 3: Geographic perspectives — global interactions

Unit 4: Power, places and networks

1. (a) Knowledge of legal and illegal goods should be established in the introduction. The answer should focus on international interactions rather than the internal movement within countries to reflect the question. National governments at different levels of development with different ideologies and perspectives can be discussed, as well as the role of nation states within multi-governmental organizations.

Possible themes for explanation include:

- the signing of bilateral and multilateral trade agreements;
- the imposition of tariffs and quotas;
- national and economic change such as an economic recession;
- the monitoring and prevention of Illegal goods flowing between countries.

Good answers may apply (AO2) a wider range of knowledge and understanding (AO1) in a **well-structured** way (AO4). One approach would be to discuss the signing of bilateral and multilateral trade agreements in order to facilitate the flow of goods and services between places. To further develop this point, candidates can recognize that this is a dynamic process and that there is temporal change since existing trade agreements can be changed or even dissolved.

NAFTA, for example, was renegotiated under a new political administration in the USA. This may reduce the flow of goods between countries, as would the imposition of quotas and tariffs on imported goods in order to protect national industrial sectors.

Another approach would be to discuss national and global changes via economic recession, which can cause detrimental effects to global trade due to economic instability. Consumer confidence is affected which reduces the need for exports and imports, as there is a reduction in spending power, therefore reducing the flow of goods and services. The flow of illegal goods should also be discussed, with specific example of strategies for preventing this movement. One strategy is the close monitoring of transportation hubs and borders. Another is the signing of international agreements. For example, the Anti-Counterfeiting Trade Agreement (ACTA), or the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, which aims to prevent the movement of harmful electronic waste.

An alternative perspective may be to explain the influence of the citizens upon the political policy, such as the Brexit referendum vote in the UK. Through this vote, it could be argued that citizens of the UK were able to express their opinion on a range of matters, including the UK being a member of the European Single market. Leaving the European Union could allow the UK greater freedom to sign its own bilateral agreements and increase trade with other nations, or alternatively lose trading relationships with their former partners in the EU.

For 4–6 marks, expect some weakly-evidenced outlining of one or two causes of either increased or decreased flows (illegal or legal).

For 7–9 marks, expect:

- either a structured, evidenced analysis of both illegal and legal flows of goods between countries;
- or a discussion of just one of these flows, but evidenced analysis for how this has increased or decreased.

For 10–12 marks, expect both of these traits.

(b) Physical barriers relate to periphery parts of the world where places struggle connect to global networks due to the isolation caused by physical geography. Economic development and technological advances have enabled places to overcome the constraints of physical geography such as extreme climate, topography and poor soils.

Relevant factors that can be discussed to demonstrate knowledge (AO1) and developed with explanation/application (AO2) are:

- the role of government or FDI investment in a place that was previous devoid of industry (unit 4.2);
- the discovery of new reserves of raw materials which will enable trade with other countries. This can subsequently result in the earning of foreign exchange, which can then be used to afford imports (unit 4.3);
- technological advances have taken place such that migrants can send remittance payments back to their place of origin, therefore establishing a flow of capital between countries (unit 4.2);
- technology now allows the movement of voice, video and data along the same lines of transmission: the internet. Since the internet can be delivered wirelessly, it is possible that places can be connected where previously communication infrastructure was a challenge (unit 4.3).

Good answers may offer a **critical evaluation** (AO3) of the extent to which places are still isolated due to physical factors, or alternatively other factors which prevent links to other countries, such as political ideology. In addition, nationalism and tribalization in some parts of a country may present differences within a country in relation to global interactions. The nationalism of resources will reduce the need to trade with other countries since the domestic needs are taken care of; for instance, the nationalization of the oil and limiting exports.

Conceptual connections include the possibility that the impact of climate change could make places at high latitudes more hospitable, with the potential to develop agriculture and build infrastructure.

Scale can be discussed in terms of isolation at a national scale vs a smaller scale, although this must link to global interactions. A key organizing concept that should be clear in the response is that of **spatial interaction,** since the focus of the question concerns space and the connections between countries.

For 5–8 marks, expect weakly-evidenced outlining of two or three relevant themes.

For 9–12 marks, expect:

- either a structured synthesis which links together several well-evidenced themes from the subject guide;
- or a substantiated evaluation that is informed by geographical concepts and/or perspectives.

For 13–16 marks, expect both of these traits.

Unit 5: Human development and diversity

2. (a) Culture can be diffused in a number of different ways and candidates will have studied these during unit 5; there should be discussion of global processes in order to reach the highest mark bands.

Possible themes for analysis include:

- the role of technology in ensuring the spread of cultural traits;
- the movement of people to other places taking their cultural identity with them;
- TNC involvement in a country which leads to sale of their goods.

Good answers may apply (AO2) a wider range of knowledge and understanding (AO1) in a **well-structured** way (AO4). One approach would be to analyse the relationship between technological developments and the spread of cultural traits such as music and fashion. The international migration of people to live and work in other countries will diffuse traits (relocation diffusion).

Another approach would be to discuss the establishment of TNCs in a country. This may mean an increase in the availability of their products. The adoption of cultural traits in some places has been fueled by an increase in disposable income and the growth of a new global middle class.

The adaption of cultural traits via processes such as glocalization, or the resistance to the spread of cultural traits in favour of domestic culture (such as the retention of the indigenous language) would offer alternative viewpoints and enable candidates to reach the higher mark bands.

For 4–6 marks, expect limited examples that are generalized and discuss how a small range of cultural traits can be diffused from one place to another.

For 7–9 marks, expect structured, evidenced analysis which includes:

- either two detailed processes showing how cultural traits are diffused;
- or a discussion of how traits can be adapted and resisted thus altering or preserving domestic culture.

For 10–12 marks, expect both.

(b) Knowledge and understanding (AO1) could be present about the following stakeholders:

- multi-government organizations involved in the transfer of capital such as the IMF and New Development Bank (unit 4.1);
- national governments in terms of trade agreements (unit 4.1) and multi-governmental organizations such as the World Trade Organization (unit 4.3);
- the role of superpowers involved in FDI (unit 4.1);
- TNCs in terms of FDI (unit 4.2) as well as their corporate social responsibility programmes (unit 5.1);
- the transfer of aid from national governments (unit 4.2);
- non-governmental organizations supporting social entrepreneurship programmes (unit 5.1);
- national governments and their political policies;
- economic migrants and the role of remittances (unit 4.3);
- United Nations socio-economic and environmental strategies (unit 5.1).

This knowledge can then be applied to the following themes (AO2):

- the developments that have taken place after the implementation of the 17 SDGs with some particular targets discussed at a national scale;
- the progress made from the giving of grants and loans to countries to develop infrastructure or alleviate debt;
- the implementation of government policies that make it difficult for companies to move overseas and offshore aspects of their company, therefore denying economic development elsewhere but ensuring that domestic jobs and development occurs;
- the investment by superpowers in low-income countries in return for raw materials can enable other industrial sectors to develop due to the construction of infrastructure, enabling revenue to be generated from imports.

Those answers that **synthesize** (AO3) three or more of these themes in a **well-structured** (AO4) way will reach the higher mark bands. The themes may involve social and economic development. **Critical evaluation** (AO3) will be present in those responses reaching the highest mark bands. For example, the success of multi-governmental organizations and other stakeholders in trying to raise the level of development in a country can be assessed and critically reviewed.

Conceptual connections can be examined such as the **power** of different stakeholders in ensuring the success of strategies; for example, the merits of a bottom-up rather than top-down approach. These **processes**, along with a range of initiatives are expected to be discussed, with the outcomes or **possibilities** examined.

For **5–8 marks**, expect weakly-evidenced outlining of two or three relevant themes.

For **9–12 marks**, expect:
- either a structured synthesis of the initiatives via several well-evidenced themes which involve a range of different stakeholders and address social and economic development;
- or a critical evaluation of the success of some initiatives including different stakeholders, in which the success of the strategies are discussed.

For **13–16 marks**, expect both of these traits.

Unit 6: Global risks and resilience

3. (a) People and places both need to be discussed in order to reach the highest mark bands. The movement of manufacturing industry refers to the relocation of factories from one country to another, such as offshoring or re-shoring, or alternatively the setting up of new manufacturing facilities by TNCs. There will some cross-overs between people and places since there is an interrelationship between the two, but students should be making distinct points about the effects upon each. In terms of places, the impact can be social, economic, environmental and political.

Possible themes for analysis relating to beneficial effects include:
- the creation of direct and indirect jobs due to offshoring strategy or due to FDI (unit 4.2);
- economic benefits from increased tax revenue via corporation and income tax if both are applied to companies and their employees.

Negative effects include:
- the spread of pollution from one place to another causing harmful health effects and damaging the natural environment, from the transfer of raw materials or from the production process (unit 6.2);
- the loss of jobs as a manufacturing processing facility moves to a different country (unit 4.2).

Good answers will show positive or negative points, and the application of knowledge (AO2) from detailed examples within a **well-structured** response will reach the higher mark bands.

For 4–6 marks, expect limited generalized examples that show how either people or places are affected in a negative or positive way.

For 7–9 marks, expect structured, evidenced analysis which includes:
- either two detailed consequences; one for people and one for places, to show how people and places are affected;
- or a discussion of how people or places can be affected both negatively and positively.

For 10–12 marks, expect both.

(b) The phrase “increase global interactions” can be examined from an economic, social and/or political perspective.

Knowledge (AO1) can be demonstrated by defining a range of “global risks” such as:
- natural hazards (geophysical and climatic);
- the negative consequences from global climate change;
- internal and external conflict (unit 6.1);
- geopolitical (unit 6.1);
- technological such as hacking (unit 6.1);
- tax avoidance (unit 6.1);
- cybercrime (unit 6.1).

Resilience—the ability of places to protect lives, livelihoods and infrastructure from the negative consequences of natural, human and environmental events—can be identified in these areas, ensuring that increasing or decreasing global interactions are linked.

Applied themes (AO2) could be:

- A number of pre- and post-event strategies can be described and explained in relation to how places are able to cope with natural hazards and also from events connected to global climate change. For example, the building of sea barrages to cope with rising sea levels.
- The impact of internal and external conflict affecting the import and export of goods and raw material production can be discussed. For example, the conflicts that have taken place in Iraq affected oil production, while increasing tension in the South China Sea will mean that major world shipping routes are affected therefore increasing the cost of raw materials such as copper and iron ore.
- In terms of restricting tax avoidance, new legislation can be created which prevents TNCs and wealthy individuals from moving their corporation or income tax to a country with a less stringent tax laws. For example, the European Commission deemed that Apple received illegal state aid from Ireland and filed a law suit against the company since it was able to move its profits from other European countries to Ireland. Additionally, the EU is moving against tax havens where very little tax is paid, such as the Cayman Islands.
- Hacking is monitored by government departments and private companies to ensure that personal and corporate data is safeguarded. If this happens, then people will feel more comfortable sourcing goods and services from places overseas, while partnerships between corporations will be further developed due to increased confidence in the technology being used.

Synthesis (AO3) can be included by addressing a range of different methods for increasing resilience and how these have enabled increased global interactions. **Critical evaluation** (AO3) could argue that, while there have been more connections between countries, there have also been barriers applied by nation states in order to protect their domestic industries which may be threatened by factors from overseas. The **power** of a cheaper currency will enable manufactured products to be sold and exported to countries that can only produce that same product at a higher price. Subsequently, trade tariffs can be implemented by countries resulting in reduced global interactions. This can also affect the international flow of capital on the stock market due to the uncertainty in the global trade market. In addition to power, the answer may explore **possibilities** from strategies related to resilience, such as the implementation of border controls in **places** in order to restrict migration from other countries.

For 5–8 marks, expect weakly-evidenced outlining of two or three relevant themes relating to different strategies and how they have increased global interactions.

For 9–12 marks, expect:

- either a structured synthesis which links together several well-evidenced themes from the subject guide, about how places become more resilient and how this has increased global interactions;
- or a critical conclusion (or ongoing evaluation) informed by geographical concepts and/or perspectives about the decreasing interactions that have taken place due to strategies connected to resilience.

For 13–16 marks, expect both of these traits.