OXFORD IB STUDY GUIDES

ANSWERS

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Geography

FOR THE IB DIPLOMA

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OXFORD

Check your understanding

Option A Freshwater – drainage basins

1. Five stores in a drainage basin include vegetation, surface, soil moisture, groundwater and channel.

2. They are open systems because there is a transfer of inputs and outputs across their boundaries.

3. Hydraulic action is the force of air and water on the sides of rivers and in cracks.
   Attrition is the wearing away of the load carried by a river. It creates smaller, rounder particles.
   Abrasion is the wearing away of the bed and bank by the load carried by a river. Abrasion increases as velocity increases.

4. The load is transported downstream in a number of ways:
   - The smallest particles (silts and clays) are carried in suspension as the suspended load.
   - Larger particles (sands, gravels, very small stones) are transported in a series of "hops" as the saltated load.
   - Pebbles are shunted along the bed as the bed or tracted load.
   - In areas of calcareous rock, material is carried in solution as the dissolved load.

5. The flow of water is much higher in winter – peaking around 28 $l/s/km^{-2}$ – whereas in the summer it is much lower – around 4 $l/s/km^{-2}$.

6. The flow is higher in winter due to higher rainfall, low temperatures (and therefore less evaporation) and less vegetation – deciduous trees have shed their leaves in winter (and so therefore less interception). In contrast, in summer, it is drier, hotter and there is more interception by vegetation.

7. For deltas to form, a heavily laden river's enters a lake or a sea with negligible currents. The river's velocity is much reduced and so it deposits its load. Vegetation may also slow the river down. In seawater, clay particles stick together and become heavier, thus increasing deposition.

8. When there are horizontal bands of hard and soft rock, the river erodes the soft rock, but the hard rock remains as a knick point and forms a waterfall. The river continues to erode the soft rock under the hard rock, so much that the hard rock collapses and the waterfall retreats up-river.

9. Climate influences hydrographs through rainfall total, intensity and seasonality. Higher intensities and seasonality should produce a steeper rising limb. Impermeable/saturated soils will also produce a steeper rising limb and higher peak flow.

10. Urban hydrographs have a shorter lag time, a steeper rising limb, a higher peak flow (discharge) and a steeper recessional limb than rural hydrographs. This is because there are more impermeable surfaces in urban areas (roofs, pavements, roads, buildings) as well as more drainage channels (gutters, drains, sewers).

11. The removal of trees and vegetation leads to decreased evapotranspiration and interception, increased overland flow (run-off) and increased stream sedimentation.

12. Urbanization leads to the construction of storm drains and channel improvements, such as channelization, enlargement and straightening. Channelization may create new channels. These are likely to be quite straight. This speeds up water movement so time lags are likely to be reduced. The purpose of channelization and straightening is to remove water from an area, and reduce the threat of a flood.

13. A levee is a raised bank of a river, whereas a flood relief channel is a new river channel designed to accommodate flood waters during times of flood.

14. Flood abatement attempts to reduce the peak flow of a flood in a drainage basin using a variety of methods including reforestation, afforestation, contour ploughing, terracing, dredging of streams and the creation of water holding features, for example, dams, temporary lakes.

15. Flood warnings could be improved by better rainfall and snow pack estimates, better and longer forecasts of rainfall, better gauging of rivers, collection of meteorological information and mapping of channels.

16. Revegetation increases interception of rainfall, and evapotranspiration, thereby reducing the amount of overland flow and, potentially, flooding.

17. Physical water scarcity exists where water consumption exceeds 60% of the usable supply whereas economic water scarcity occurs where a country physically has sufficient water resources to meet its needs, but additional storage and transport facilities are required.

18. Drought is an extended period of dry weather leading to conditions of extreme dryness.

19. Salinization refers to an increase in the amount of salt in the soil. This often happens due to irrigation in hot regions. This occurs when groundwater levels are close to the surface. Capillary forces bring water to the surface where it may evaporate, leaving behind any soluble salts that it is carrying.

20. Eutrophication leads to the nutrient enrichment of water bodies. The increased nutrients leads to algal blooms, oxygen starvation and, eventually, a decline in species diversity.

21. Lakes may be polluted by run-off from agriculture (chemical fertilizers and sewage), release from power stations, oil discharge from ships and vehicles, acidification and industrial effluent.

22. Aquifer.

23. It will receive a share of the energy; it will control flooding, increase the amount of water for irrigation and increase agricultural output.

24. Egypt fears that it will receive less water and so have less potential for HEP and for irrigation.

25. There are very high concentrations of large dams in North America (especially USA), western Europe, India, east China and Japan. In addition, there are large numbers of large dams along the east coast of Brazil, the east coast of Australia and in Southern Africa. In contrast, there are relatively few large dams in parts of central South America, central Africa, North Africa, Indonesia, central Australia, and northern Russia and northern Canada. There are few large dams in periglacial areas, hot desert areas and some rainforest areas.

26. The main advantages of building large dams include flood and drought control, irrigation, hydroelectric power, improved navigation, recreation and tourism.

27. Integrated drainage basin management (IDBM) plans aim to deliver sustainable use of the world's limited freshwater resources. They use a basin-wide framework for water management that is economically, socially and environmentally sustainable.

28. The Lower Danube Green Corridor consists of about 700,000 ha of protected wetland areas, and has led to reduced pollution, purified water, less flooding, greater support for fisheries and tourism, and the provision of new habitats for wildlife.

29. Wetlands provide many important social, economic and environmental benefits. These include water storage, groundwater recharge, storm protection, flood mitigation, shoreline stabilization, erosion control, and retention of carbon, nutrients, sediments and pollutants. Wetlands also produce goods that have a significant economic value such as clean water, opportunities for tourism, fisheries, timber, peat, and wildlife resources. Wetlands are important regulators of water quantity and water quality. Floodplain wetlands, for example, store water when rivers over-top their banks, reducing flood risk downstream. Wetlands also regulate water quality.

30. Natural causes of wetland loss include sea-level rise, drought, hurricanes and other storms, and erosion. In contrast, human causes of wetland loss include reclamation of wetlands, and dam construction causes the greatest loss of wetland habitat. Other causes include the conversion for aquaculture, mining of wetlands for peat, coal, gravel, phosphate and other materials, and groundwater abstraction.

31. Water harvesting refers to making use of available water before it drains away or is evaporated. It aims to capture and channel a greater share of rainfall into the soil, and conserve moisture in the root zone where crops can use it.

32. The main objective of South Africa's water law principles is to manage the nation's water resources to achieve optimum long-term social and economic benefit for South Africa's society from their use of water resources.

Check your understanding

Option B Oceans and coazstal margins

1. The effect of ocean currents on temperatures depends upon whether they are cold or warm. Warm currents from equatorial regions raise the temperatures of polar areas (with the aid of 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, there are other areas which 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.

2. Ocean currents may raise temperatures and therefore have an impact on length of growing seasons/ productivity, recreation and tourism etc. They may also provide upwelling nutrients and form the basis of a fishing industry.

3. During normal conditions, sea surface temperatures (SSTs) in the western south Pacific Ocean are over 28°C, causing an area of low pressure, and producing high rainfall. By contrast, over coastal South America SSTs are lower, high pressure exists, and conditions are dry.
   During El Niño episodes, water temperatures in the eastern Pacific rise as warm water from the western Pacific flows into the east Pacific. SSTs of over 28ºC extend much further across the Pacific. Low pressure develops over the eastern Pacific, high pressure over the west. Consequently, heavy rainfall occurs over coastal South America whereas Indonesia and the western Pacific experience warm, dry conditions.

4. The impacts of the 2015 El Niño event were varied, and included 100 million people being short of water and food; southern Africa experienced its driest year for 35 years; nearly one million children in East Africa and Southern Africa were treatment for malnutrition; there were heat waves and water shortages in Asia; food prices rose by 50% in Zimbabwe; in South America the Zika virus was able to spread easily (more stagnant water for breeding), and, Central America had one of its most severe droughts in history.
5. The distribution of hurricanes is mainly in tropical areas, away from the equator, and mostly on the western side of oceans. There are some exceptions such as on the north-east side of Australia and off the west coast of central America.

6. The main impacts of Typhoon Haiyan were the deaths of over 10,000 people; about 70–80% of the buildings in the area in the path of Haiyan were destroyed. There were winds of up to 315 km/h (195 mph) and a storm surge of 6 m. These tore roofs off buildings, flooded roads, knocked down electricity pylons, making communication possible only by radio.

7. Ocean acidification is caused by the increase in man-made sources of carbon, sulphur and nitrogen from burning fossil fuels and land-use changes (deforestation).

8. Atmospheric carbon dioxide is taken in by the ocean, and becomes dissolved. It reacts with seawater to produce carbonic acid, lowering the water's pH level and making it more acidic. This raises the hydrogen ion content in the water, and limits organisms' access to carbonate ion, which are needed to form hard parts.

9. The swash moves water and sediment up the beach in the direction of the prevailing wind. The backwash moves water and sediment down the beach at right angles to the sea (the direction of the steepest angle).

10. Two forms of hydraulic action are wave pounding – the direct force of water crashing on a cliff/beach, and hydraulic pressure –
    the compression of trapped air and then its sudden release.

11. Wave-cut platforms result from the erosion of a cliff by hydraulic action. As the cliff gets eroded further back, it is replaced by a lengthening wave-cut platform. Platforms are typically about 1° and up to 500 m long. Eventually the cliff is subjected to sub-aerial forces rather than marine forces, and a lower angle cliff is produced.

12. A spit is a ridge of sand or shingle attached at one end to the mainland. Spits are formed on indented coastlines or at river mouths. Longshore drift transports the sediment along the coastline and deposits its sediment at a change in the coastline. Wave refraction and occasional storm waves may bend the spit inwards towards the coastline. Spits are often characterized by a salt marsh behind the spit, caused by the build up of river deposits in the low energy environment.

13. Sea level some 20,000 years ago was around 150 m below current sea level. It rose until about 5000 years BP (before present) when it was higher than today. During its overall rise, it fluctuated greatly. It fluctuated until about 2000 BP when it reached its current level.

14. Emergence and deposition can lead to advancing coasts while erosion and submergence can lead to retreating coasts.

15. Conditions on the beach are likely to be windier and drier. Further inland, wind speed is reduced by vegetation, and there is also less evaporation.

16. The dunes near the beach consist mainly of sand – hence yellow dunes. The dunes further inland consist of sand and some humus (decaying vegetation) which gives the dunes a grey colour.

17. Gabions are wire structures consisting of small rocks that absorb wave energy whereas rock armour refers to large rocks placed at the base of a cliff or a beach to absorb wave energy/deflect wave energy.

18. Cliff drainage refers to the removal of water from within the cliff; vegetating cliffs occur in order to increase interception and to reduce overland flow; cliff regrading occurs to lower the slope angle and make the cliff safer.

19. The MRAs are used to allow fish stocks to regenerate, and to protect marine flora and fauna. They permit snorkelling and diving by permit.

20. The stakeholders include commercial and subsistence fishing, tourists, workers in the tourist industry, conservationalists, yacht enthusiasts, local residents and farmers.

21. Coral reefs are of major biological and economic importance. About 4,000 species of fish and 800 species of reef-building corals have been identified. Coral reefs are important fish nurseries. They are also important in protecting coasts against erosion. Countries such as Barbados, the Seychelles and the Maldives rely on tourism. The global value of coral reefs in terms of fisheries, tourism and coastal protection is estimated to be US$375 billion!

22. The ecological services that mangrove swamps provide 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.

23. An economic exclusive zone (EEZ) is an area in which a coastal nation has sovereign rights over all the economic resources of the sea, seabed and subsoil, extending up to 200 nautical miles from the coast (the international nautical mile is 1.852 km).

24. There are believed to be substantial deposits of oil and natural gas. It will be easier to mine for them, and much safer, if there is no ice. There could also be increased potential for fishing. An ice-free Arctic would open up trade routes between North America, northern Europe and Russia.

25. Many of the abiotic resources are located at great depth, over 4 km, which makes it technologically difficult to recover and very expensive.

26. Oil spills may contaminate coasts and oceans; benthic species may be affected by toxicity related to oil developments; some marine mammals can be disorientated due to acoustic prospecting.

27. Capture fisheries increased steadily from about 20 mt in 1950 to around 90 mt in 1990. Since then it has plateaued. In contrast, aquaculture starts very low in 1950, reaches about 10–15 mt in 1990 and increases significantly to around 80 mt in 2013.

28. The proportion of the world's fisheries that are underfished has fallen from about 40% in 1974 to about 10% in 2013. The proportion that are fully fished has risen from around 50% in 1974 to 60% in 2013. In contrast, the proportion that are over-fished has increased from around 10% in 1974 to about 30% in 2013. Thus the world's fish stocks are becoming less sustainable.

29. The explosion of the Fukushima-Daiichi nuclear power station released radioactive material into the atmosphere. Some fell into the ocean where it was carried by ocean currents to Canada and the USA.

30. The Great Pacific Garbage Patch is believed to contain around 100 mt of plastic suspended at the surface of the ocean.

31. China, Taiwan, Vietnam, Malaysia, the Philippines and Brunei.

32. Control of the South China Sea provides access to resources (including oil and gas) and provides control of shipping routes.

Check your understanding

Option C Extreme environments

1. Periglacial environments are found at high latitudes in the northern hemisphere – there are no major land masses at a similar latitude in the southern hemisphere (apart from Antarctica). In contrast, hot desert areas are generally located around the tropics (20°-30° North and South) and are associated with the sub-tropical high pressure belt.

2. The world's main mountain ranges are mainly located along tectonic plate margins, for example, the destructive plate margin along the west coast of South America and the collision boundary between the Eurasian and Indian plates, forming the Himalayas.

3. Periglacial environments may have low temperatures, but these rise above freezing during the summer/daytime. Ice is a characteristic feature of the climate. Periglacial areas are also characterized by snow – precipitation levels are generally below 500 mm.

4. The desert climate is hot throughout the year, with temperatures ranging between 20°C–30°C. Rainfall is low, less than 400 mm, and is spread fairly evenly throughout the year.

5. Relative humidity is most "comfortable" when it is between 20% and 80%, and the most "comfortable" temperature is between about 20°C and 25°C.

6. Indigenous people in periglacial areas tend to be migratory, moving north into the tundra during the brief months of summer and heading southwards to the forest margins in winter. For many indigenous peoples, fishing is extremely important. To cope with the cold conditions Inuit populations have evolved a layer of fat which protects them from the extreme cold.

7. There was perhaps three times as much snow and ice during the Pleistocene as there is today. For example, there were extensive ice caps and ice sheets over North America and north-west Europe compared with today. There was more ice over Siberia, but not as much as over North America or north-west Europe.

8. The evidence for climate change in the Sahara Desert includes wadis (former steep river valleys), the remains of small crocodiles, pollen from oak and cedar, cave paintings made by pastoralists, fossil soils and fossil water, and fossil ergs which may have been formed by water/wind.

9. Cirques are generally found on the slopes of mountains where accumulation is highest and ablation is lowest. They are formed in stages: a preglacial hollow is enlarged by freeze-thaw and removal by snow melt; ice accumulates in the hollow; when the ice is deep enough, it moves out in a rotational manner, eroding the floor by plucking and abrasion; the cirque continues to grow by freeze-thaw; after glaciation an armchair-shaped hollow remains, frequently filled with a lake.

10. The material that is plucked by glacier movement is used to abrade the surface/materials over which the glacier moves.

11. Drift refers to all glacial and fluvioglacial (meltwater) deposits left after the ice has melted. Till refers to glacial deposits, and are angular and unsorted.

12. Terminal moraine is located at the point of maximum extent of a glacier, and occurs at right angles to the valley, whereas lateral moraines are found along the sides of a glacial valley.

13. Solifluction means flowing soil. In winter water freezes in the soil causing expansion of the soil and separation of individual soil particles (peds). In spring the ice melts and water flows downhill. It cannot infiltrate deep into the soil because of the impermeable permafrost. As it moves over the permafrost it carries separated soil particles and deposits them further downslope as a solifluction lobe or terracette. In contrast, frost heave "lifts" the surface upwards, as water freezing raises the position of peds and stones towards the surface.

14. Clearance of vegetation by human activity may remove surface layers and so open the permafrost to raised air temperatures in summer. For example, the clearing of the forest for agricultural purposes near Fairbanks, Alaska, in the early 1920s led to the development of extensive pattern of thermokarst mounds varying in size from 3–15 m diametre, and 0.3–2.4 m high.

15. In hot desert areas there is a large diurnal temperature range. In many desert areas day-time temperatures exceed 40°C whereas night-time ones are little above freezing. Rocks heat up by day and expand, whereas at night they cool down and contract. As rock is a poor conductor of heat, the stresses related to expansion and contraction occur only in the outer layers. This causes peeling or exfoliation to occur. Some moisture is essential for this to happen.

16. Deflation is the removal of small materials, leaving behind larger stones. In contrast, abrasion is the erosion carried by material carried by the wind.

17. Aridity refers to a relative lack of moisture whereas infertility refers to a lack of minerals/nutrients/organic matter in a soil.

18. Sources of water include rivers, oases, precipitation (rainfall, fog), groundwater and the desalination of seawater.

19. There are many resources present, such as oil or copper, and these can be exploited to create jobs, wealth and economic development. In addition, there are multiplier effects of resource exploitation, such as the construction of new settlements, transport infrastructure and the development of services/utilities.

20. Resource exploitation may lead to air and water pollution, visual intrusion, destruction of habitats and a reduction in the water table.
21. Permafrost can be a problem if exposed to heat, causing it to melt, leading to subsidence. Any structure built on or in permafrost is therefore vulnerable to collapse.

22. "Resource nationalism" exists when a country takes control of its own natural resources.

23. The environments are vulnerable to population pressure. In arid areas, scarce water resources may be used for tourist facilities such as swimming pools and golf courses. Natural habitats may be removed to make way for new facilities. In high/cold environments, new developments may disturb permafrost, remove habitat and lead to an increase in pollution.

24. The main attractions include Zuni culture, history and physical geography/landscape.

25. Desertification is land degradation in humid and semi-arid areas (non-desert areas); involves the loss of biological and economic productivity; it occurs where climatic variability (especially rainfall) coincides with unsustainable human activities.

26. Overgrazing can lead to the destruction of vegetation by cattle, sheep and goats, especially around boreholes and wells. Without any vegetation to protect the soil, the soil is easily eroded by wind and water. Over-cultivation may lead to soil exhaustion and make soil unable to contain vegetation. Without the vegetation, the soil is easily eroded. Similarly, deforestation to make land available for farming may leave the soil bare for a while, and vulnerable to erosion by wind and water.

27. The Nenets have been pushed away from their traditional grazing lands. Oil pipelines and roads are difficult for reindeer to cross. Oil pollution has led to a deterioration in water quality and the quality of pasture. In addition, fish catches have decreased, and fish spawning grounds have been polluted.

28. It is believed that there are 55 trillion cubic metres (tcm) of natural gas in the Yamal Peninsula.

29. Currently around 1% of the world's population depend on desalinated water, but this figure is expected to rise to 14% by 2025.

30. Due to their clear skies and large amounts of sunlight, hot arid areas have excellent potential for solar energy.

31. For some cold environments, rising temperatures may pass a tipping point. If ice melts, a white surface is replaced by a darker surface with a lower albedo. The surface will absorb more insolation, and so will heat up even further. Sea ice may disappear, making hunting very difficult for polar bears. Rising temperatures could also lead to melting permafrost, and subsidence of many built structures.

32. Methods to reduce the effects of rising temperatures in hot, arid countries include improving soil fertility by the careful use of fertilizers; desalination and reservoir development to increase the availability of freshwater; improving the efficiency of irrigation systems and pest control; adopting water and soil conservation techniques using diguettes (stone rows) to reduce run-off on slopes; developing massive lines of trees to combat the combined effect of resource degradation (deforestation and soil erosion) and drought/desertification.

Check your understanding

Option D Geophysical hazards

1. Convection currents are the main source of heat flow within the Earth's crust, followed by conduction and advection.

2. Subduction refers to the plunging of one plate beneath another. Subduction zones form where an oceanic plate collides with another plate – whether continental or oceanic. The denser plate plunges under the less dense plate.

3. Shield volcanoes are low angle volcanoes. They are formed from very hot, runny basaltic lava. Because it is so hot, the lava can flow great distances. It builds up shield volcanoes, which have gently sloping sides, a shallow crater and a large circumference.

4. Hazards associated with volcanoes include primary hazards such as lava flows, heat, pyroclastic flows, ash, dust and emissions of chemicals; secondary hazards include lahars, landslides, famine and contaminated water.

5. The focus is the exact point within the Earth where an earthquake has occurred (and can be shallow focus or deep focus) whereas the epicentre is the point on the Earth's surface directly above the focus.

6. The potential impacts of an earthquake include loss of life,
loss of livelihood, total or partial destruction of buildings, disruption of water supplies, breakage of sewage disposal systems, loss of public utilities such as electricity and gas, floods due to collapsed dams, release of hazardous materials, fires, and spread of chronic illness due to lack of sanitary conditions.

7. Landslides vary in speed from about 1 cm to 10 cm/day, whereas soil creep occurs at rates of up to about 1 mm/day.

8. (i) Rockslide (ii) Solifluction or seasonal soil creep.

9. Broad belts of earthquakes are associated with subduction zones (where a dense ocean plate plunges beneath a less-dense continental plate), whereas narrower belts of earthquakes are associated with constructive plate margins, where new material is formed and plates are moving apart. In contrast, most volcanoes are found at plate boundaries although there are some exceptions, such as the volcanoes of Hawaii, which occur over hotspots. About three-quarters of the Earth's 550 historically active volcanoes lie along the Pacific Ring of Fire.

10. Fatal landslides tend to be more common in areas that have: active tectonic processes that lead to high rates of uplift and occasional seismic events; high levels of precipitation, including high annual totals and high short-term intensities; and a high population density.

11. Frequent events are of a low magnitude (and cause little destruction/loss of life) whereas high magnitude events are very infrequent, but cause much damage/loss of life.

12. A VEI 8 might be expected to occur at most once every 10,000 years (the last was 75,000 years ago) whereas a VEI 5 (Mt St Helens) could be expected on average about once every 50 years.

13. Governments may decide to take an isolationalist approach –
as the Burmese government did in 2008 following Cyclone Nargis – and prevent international aid from helping. In contrast, governments can be interventionalist – as with China in 2008 – and attempt to help individuals as quickly as possible.

14. The elderly are more vulnerable to geophysical hazards, due to a lack of mobility. Similarly, women/carers may be more vulnerable, as well as children and infants. People with a disability may be unable to get to safety alone, this is also true for some immigrant groups.

15. On a Sunday, fewer people are at work or shopping, so the number of people in a city centre may be lower than during the week. An earthquake of the same magnitude would have a greater impact on a weekday than at the weekend.

16. High magnitude events have a greater impact than low magnitude events, for example, a VEI 5 would cause more damage than a VEI 2. The more aftershocks there are the greater the damage that is done, although normally high frequency/low magnitude events generally do not do much damage.

17. The hazard risk profile for volcanoes in California shows that eruptions are rare, only affect a relatively small area, last for a few days and provide little warning of an eruption.

18. The hazard profile for earthquakes in Nevada may be different to that of California, as California has an active plate boundary. The nature of slopes may vary, and there could be more buildings at risk closer to the plate boundary. Similarly, one area may have more frequent earthquakes due to the construction of large dams. Hazard profiles vary from place to place.

19. The earthquake hazard profile suggests that it is a rare event, is short in duration, is of limited areal extent, occurs rapidly, and is relatively concentrated and random in time.

20. The reasons why the 2011 Christchurch earthquake was more devastating than the 2010 earthquake include: the epicentre was closer to Christchurch; it was shallower at 5 km underground, whereas the September 2010 quake was measured at 10 km deep; the 2011 earthquake

occurred at lunchtime on a weekday when the CBD was busy; many buildings had already been already weakened by previous earthquakes.

21. The highest risk is in the south, and it has been made into an Exclusion Zone. The narrow central belt (around 4 km north of the volcano) is also at risk – residents must be able to evacuate within 24 hours, and have hard hats and dust masks. The Northern Zone (about 6 km and over from the volcano) has a much lower risk.

22. Previous eruptions of Mount Sinabung have led to the creation of a fertile plateau, and this has led to a high population density as it is a productive agricultural area on account of the fertile soil.

23. Poor water management (including the inability to cope with heavy monsoon rainfall) and slope disruption (building terraces and creating mini-cliffs).

24. There are many costs in attempting to manage landslides including the cost of research into the extent and nature of landslides; the cost of protection schemes; the cost of drainage and regrading; and the costs of monitoring potentially unstable slopes.

25. The total number of natural hazards appears to have increased between 1994 and 2013, and thereafter remains quite erratic but between approximately 350 to 450 p.a. The greatest number of natural hazards is in Asia, rising from about 100 in 1994 to about 150 in 2006. Oceania has the smallest number of natural hazards throughout the whole period.

26. High income groups have a disproportionately low percentage of deaths compared with the percentage of natural hazards that they experience. In contrast, low income groups have a much higher percentage of deaths caused by natural hazards compared with the percentage of natural hazards that occur there.

27. Land-use zoning means that certain land uses are not permitted in areas "at risk" of a hazard. For example, hospitals and high density buildings should not be located close to a fault line or a steep slope. Compatible land uses may include sports fields, recreation grounds, grazing land, conservation areas or nature reserves.

28. Some people cannot afford the cost of insurance. Some insurance companies will not insure against "acts of God". Some people may be fatalist in their approach and will not bother to take out insurance.

29. Heavy roofs may collapse in an earthquake whereas light sheet metal roofs may stay in place. Small regularly spaced windows create fewer weak spots in walls.

30. Old tyres filled with sand or stone, and placed between the floor and the foundations, can act as a shock absorber.

31. The search and rescue stage lasts up to about 10 days.

32. The main process taking place at around 4–5 weeks is the restoration of major services.

Check your understanding

Option E Leisure, tourism and sport

1. The growth of leisure has been facilitated by many factors including a reduction in the length of the working day; a reduction in the length of the working week; an increase in wages; an increase in disposable income; the growth of leisure activities; more early retirement; an increase in self-employment and flexi-time, and developments in technology which enable people to spend less time on chores, and other developments in technology, such as TVs and the internet, which provide opportunities for leisure.

2. The countries are a mix of high income countries and middle income countries/emerging economies and are mainly located in Europe and North America.

3. Mass tourism holidays are a high density form of tourism and often last for between 7 and 14 days. This type of tourism is most frequently found in coastal areas, for example, the Costa del Sol, Spain, and is typically provided as a package holiday (transport and accommodation arranged together). In contrast, ecotourism is largely a low-impact form of tourism. Nevertheless, some forms of ecotourism can be very expensive, such as gorilla watching, since it costs a great deal to get to the remote locations in which they occur.

4. Jogging/running is free/popular with people of many ages, and can occur in most locations (excluding unsafe/extreme environments). Water sports are likely to be costly, less popular, and located in coastal areas, rivers, lakes and swimming pools.

5. As countries are industrializing, there may be large numbers of migrant workers, many of whom will work long hours. Their potential to participate in leisure activities may be limited not only due to long working hours, but also to having to share accommodation, and sending money home.

6. Leisure activities are limited in low income countries as many people do not have the disposable income to buy appliances such as televisions. They also may not feel inclined to take part in leisure activities as they may be malnourished or tired and weak.

7. Some people have more opportunities to participate in tourism –
couples with children have more responsibilities/less disposable income and so they may have less opportunity to participate in tourism. Older couples, whose children have left home, may have more time/resources/opportunity to participate in sport or tourism.

8. Young people (aged 16–24 years) are overall more likely to participate in all three activities combined. In contrast, the 25–44 year old group are more likely to participate in walking and cycling than any other year group. Walking remains the most population activity for all age groups over the age of 25.

9. Oxford developed into a tourism hotspot due its many attractions. The most popular attractions include the Botanic Gardens, the Ashmolean Museum and many Oxford University colleges, notably Christ Church College. Other attractions included Blackwell's Bookshop, the Old Bodleian Library and the Sheldonian Theatre.

10. The Killarney National Park Management Plan identifies four main zones: 1 the natural zone: where nature conservation is the primary objective; 2 a cultural zone: where the primary objective is the conservation of noteworthy features resulting from human activities including estate landscapes, archaeological and historic sites, buildings and structures; 3 an intensive management zone: where basic park objectives other than conservation are emphasized, provided park resources are not adversely affected; 4 a resource restoration zone: removal of non-native conifer plantations.

11. The sphere of influence refers to the area from which a facility or an attraction draws its support.

12. A village will have only a few facilities, such as a community hall, open space and a mobile library, and offer opportunity for a few activities such as badminton, keep fit, yoga, football and cricket. In contrast, a city is likely to contain tennis courts, gyms, sports halls, swimming pools, specialist sports venues, golf courses, skateboard parks, bowling rinks, sports stadia and athletic grounds. A city can offer, among other opportunities, tennis, netball, gym activities, hockey, bowling, golf, karate and judo, as well as the chance to see professional sports players in action.

13. Many of the fans can follow their team on television or the internet and so do not have to live close to the team's sports ground, hence, teams can have an international fan base.

14. The Currie Cup is the main provincial competition in South Africa.

15. (a). The number of visitors has increased relatively steadily from 1970 to 2010, when it reached about 130,000.
    (b). Ticket prices increased slowly from 1970 until about 1980, and since then they have increased at an accelerating rate (exponential increase).

16. Environmental problems include air pollution due to CO_2 emissions, which increase dramatically during June when the three-day festival is running. Car transport is still very popular because of its flexibility. Waste disposal is another problem. This consists mainly of human waste, empty plastic water bottles and tents. Energy, water and food need to be supplied and residue is disposed of. The tents present an enormous problem because many

fans leave them behind at the end of the festival and their condition is not good enough for charity use. Noise pollution is another problem. Many of the performances continue through the night, which causes disturbance to local residents.

17. Heritage tourism provides valuable foreign exchange, which can be invested in local services and projects, connected to development; extra tax revenue for the government is derived from accommodation, restaurants, airports, and ticket sales; direct employment (for example, accommodation and guides) and indirect employment (food production and housing construction); tourism can also produce a "multiplier effect" whereby money generated in one sector of the economy benefits other sectors.

18. Visitors are causing footpath erosion; heavy rainfall, steep slopes, deforestation and trampling of vegetation can lead to landslides; and the local infrastructure cannot cope with recent urbanization – the Urubamba river is overloaded with untreated sewage and its banks are covered with rubbish.

19. Tourists from HICs (and increasingly those from LICs too) demand high standards. TNCs are often more able to provide these than the smaller independent operators. TNCs can introduce a diverse range of new technologies and skills into an economy including advanced management, environmental and financial systems.

20. There are at least six stakeholders in the planning of tourism – each will try to push their own interests in tourism planning.

21. Tourism is labour-intensive and can overcome the problem of unemployment both in rural and urban environments. The tourist economy provides jobs directly (tourist welfare, catering, transport, guiding and accommodation) or indirectly (construction, engineering and food production). Tourism also provides opportunities to acquire new skills, for example, in languages, catering and entertainment. Tourism can create a multiplier effect, which means that income gained by local people is circulated through the economy by their purchasing of products within the host area.

22. TNCs are likely to have an impact on accommodation, some food/catering and banking facilities in the tourist destination.

23. The economic advantages include trade and tourism. The event may make a profit through sales of radio and TV rights, tickets and merchandise, as well as spending in hotels, restaurants etc.

24. There may be financial problems. The London Olympic Games cost around £11 billion (plus the cost of infrastructure developments) and received lottery funding of £675 million, which could have gone elsewhere. Some people and businesses did not want to move but were forcibly relocated. There were regional development impacts too – London and the south-east received the bulk of the funds, increasing inequalities compared to the rest of the country.

25. Physical carrying capacity is a measure of absolute space, for example, the number of spaces within a car park, whereas perceptual capacity is the level of crowding that a tourist will tolerate before deciding the location is too full.

26. Although Venice has seen an increasing number of cruise liners and passengers, cruise passengers do not stay in hotels, generally they do not eat large meals in Venice, and often they have their own guide.

27. Sustainable development has been defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Sustainable tourism therefore needs to: ensure that renewable sources are not consumed at a rate that is faster than the rate of natural replacement; maintain biodiversity; respect local cultures, livelihoods and customs; involve local people in development processes; and, promote equity in the distribution of the costs and benefits of tourism. Similarly, ecotourism is a "green" or "alternative" form of sustainable tourism. It generally occurs in remote areas, with a low density of tourists. It operates at a basic level. Its characteristics include increasing involvement and control by local or regional communities, and, a balance between conservation and development between environment and economics.

28. The advantages of ecotourism for the residents of the Monteverde Cloud Forest include the creation of new jobs and the generation of wealth. New businesses have been created, including hotels, bed and breakfasts, restaurants, craft stalls, riding stables, private reserves, hiking trails, hummingbird galleries, frog ponds and a butterfly and botanical garden. Over 400 full-time and 140 part-time jobs have been created. In addition, there are indirect employment and multiplier effects. Local farmers provide much of the food consumed by tourists to the area. The increase in small businesses means that income should be more evenly distributed.

29. The number of international tourists is set to increase and reach 1.8 billion by 2030. The main areas of growth are in Asia-Pacific and in the European Union. There is growth in all regions, although Africa and the Middle East have the smallest shares.

30. Diaspora tourists are more likely than most international tourists to have or make connections with the local economy. They are more likely to stay with relatives,

or in locally owned businesses (for example, bed and breakfast accommodation), to eat in local restaurants, go to local pubs etc. Although they might not spend as much money as international tourists, it is more likely to go directly to local businesses. Thus, diaspora tourism can have positive development potential. Moreover, diaspora tourism is not as seasonal as international tourism, and may be spread more evenly throughout the year.

31. In 2012, UN Women and the International Olympic Committee (IOC) signed a partnership agreement to promote women's empowerment through sports. Sport can contribute to building the psychological well-being, leadership capacity and empowerment of girls and women, while enhancing their roles and integration in society. Its aim to promote women in and through sport at all levels aligns with the principles and work of UN Women, in its work to advance gender equality and the empowerment of women worldwide.

32. According to the infographic, in 1900 just 2.2 per cent of athletes were women, but by 2012 this figure had increased to 44 per cent.

Check your understanding

Option F The geography of food and health

1. Child wasting is the proportion of children under the age of 5 who suffer from low weight for their height, reflecting acute or periodic undernutrition. In contrast, child stunting is the proportion of children under the age of 5 who suffer from a low height for their age, reflecting chronic or long-term undernutrition.

2. Hunger is "serious" in sub-Saharan Africa and South Asia. Sub-Saharan Africa has a Global Hunger Index of 32.2, while South Asia's is 29.4.

3. In 2011, people in HICs consumed on average around 3,400 calories/day and consumed over 100 g/protein/day. In contrast, people in LICs consumed about 2,750 calories/day and under 80 g/protein. People in HICs consumed a smaller proportion of cereals and a higher proportion of meat and dairy produce than people in LICs.

4. In HICs the proportion of cereals consumed fell between 1961 and 1973 and 2009 and 2011, while the proportion of sugar, meat and vegetable oils increased. In contrast, in LICs, the amount of cereals consumed increased and vegetable oil and meat accounted for a greater proportion of the total diet during the same time. People in HICs obtained most of their protein from meat and dairy, while the amount they obtained from cereals fell. In contrast, in LICs, cereals account for over one-third of protein, although there has been an increase in the amount obtained from meat and dairy.

5. The IMR is a good indicator of development as it is an age-specific rate, and so is not affected by the age structure of the population. There is also a strong correlation between the IMR and the HDI. Countries with a good health care system, high rates of literacy and wealth generally have low IMRs, whereas those with a low HDI, and lacking in basic facilities, have a high IMR.

6. The number of doctors/number of people is not necessarily a good indicator of the quality of the health care system, as it does not take into account the quality of the doctors, their specialisms, the number of hospitals and bed spaces, the number of nurses, type of health care service etc.

7. "Diseases of poverty" are infectious or contagious communicable diseases such as respiratory diseases, measles and gastroenteritis (diarrhoea and vomiting). By contrast, "diseases of affluence" include heart attack, stroke and cancers, that is, diseases that are not infectious or communicable.

8. In 1990, China's leading cause of premature death was lower respiratory infections. Two of the top three causes of premature death were communicable or infectious diseases. In contrast, in 2013, the leading causes of premature death were degenerative, non-communicable diseases. Of the ten leading causes of premature death in 2013, seven were degenerative (compared with only 4 in 1990) whereas only one was communicable/infectious (compared with three in 1990). Thus, China has experienced/is experiencing an epidemiological transition.

9. Most of the tropical rainforest is left standing and is harvested/gathered rather than cut down/burnt. Natural vegetation is allowed to re-seed itself. There is some hunting, and some trade for maize seed. The farming system uses a small area, only enough to grow/gather/hunt for the households' subsistence needs, and a small amount of trade.

10. There is a limited need for energy (apart from the sun) in a agroforestry/hunter gatherer farming system, whereas in a greenhouse system there can be a very large amount of extra heating (energy).

11. Food availability refers to there being a sufficient quantity of high quality food in an area. Food entitlement refers to a person's right to food – either because they produce the food or they have a job which pays wages, and they use their wages to buy food.

12. Migration may lead to the adoption of new foods, for example, in Bahrain the adoption of Indian food such as samosas, chapattis, nashif and keema, and Iranian shish kebab. Alternatively, some migrants may have a very poor diet, owing to their long working hours, limited cooking facilities, and inability to get to good food stores during the working day.

13. Initially, adoption may be slow, as the benefits may be unclear, or it may be expensive to afford the new technology (this is the bottom of the "S" shape). As information becomes more widespread, and often the cost is reduced, increasingly more people adopt the idea (adoption increases rapidly – this is the middle of the "S" shape). However, some people are reluctant to change and take a long time to accept a new technique, if they ever do (adoption slows and plateaus – this is the top of the "S" shape).

14. People transported the virus by travelling to and from areas with the disease (relocation diffusion) whereas the mosquito is a poor flier (and can fly only about 400 m) so the potential for expansion diffusion is limited.

15. The malarial parasite (plasmodium) lives in the humid tropics and requires a minimum temperature of 20°C to breed. Hence they are limited to hot, humid climates. The mosquitoes also require stagnant water to breed, such as pools and irrigation channels.

16. This infection mostly causes mild gastroenteritis. However, about 5% of infected persons develop severe dehydration and acute diarrhoea, which can kill within

hours. There are 28,000–142,000 deaths from cholera every year.

17. The intergenerational cycle of hunger suggests that a malnourished mother is likely to give birth to a low birth weight child, who will stay malnourished. The child's growth in the first few years of life are likely to be reduced, physically and mentally. The child's chances of success at school, and of eventually finding a well-paid job are limited, so the child becomes an adult but remains in poverty. The cycle continues.

18. Farm subsidies allow farmers in the country where subsidies are provided to grow more, to buy more fertilizers/irrigation water/machinery etc., and that makes them more competitive than farmers that do not get the extra support. Thus they are able to produce more, and may even waste more as they do not have to cover the full costs on their own.

19. The main change in diet related to the growth of TNCs is to one that is dominated by standardized, mass-processed foods, which may be rich in salts and sugar. They are essentially fast foods.

20. Reasons for the increasing consumption of fast food include increased standard of living (and so an ability to buy food), urbanization (possibly working long hours and the purchase of convenience foods), the decline of the traditional family and the increase in more single people, the decline in agricultural households, so fewer people growing their own food.

21. Women face discrimination both in education and employment opportunities and within households, where their bargaining power is lower than men's. They also have less access to land, training, technologies, finance and other services. Women tend to be responsible for food preparation and childcare within the family and are more likely to spend their income on food and their children's needs. These demands on their time limit the amount of farm work that they can do relative to men.

22. The "sandwich generation" is the adult generation (workers) caring for both their own children and their own parents (dependent population). It is particularly important in China for two reasons. First, in China, children are legally bound to look after their parents. Second, as a result of the one-child policy, there are relatively few young people, and, as the population ages, adults could end up caring for five people, that is, their four parents and their one child.

23. The north-east and centre of the country were up to 35% drier, and only a few areas in the south-east were significantly wetter. Most of the south and west of the country experienced normal rainfall, that is, within 5% of the 1981–2014 average.

24. The humanitarian disasters around the world, such as in Syria and South Sudan, not only dominated media coverage but they also received more international aid. This meant that the famine in Ethiopia attracted less attention and fewer donations.

25. Approximately one-third of food is thrown away in the UK each year, whereas in LICs, up to 80% may be wasted before it reaches the market/shops. In HICs produce is often wasted through retail and customer behaviour. Major supermarkets, in meeting consumer expectations, often reject entire crops of perfectly edible fruit (for example, "sell by" dates and "best before" dates). In LICs wastage tends to occur primarily at the farmer–producer end of the supply chain. Inefficient harvesting, inadequate local transportation and poor infrastructure mean that produce is frequently handled inappropriately and stored under unsuitable conditions. Mould and pests destroy or at least degrade large quantities of food material.

26. Bangladesh improved food security by increasing production of rice using irrigation water and high-yielding varieties, improved storage facilities for rice, and cold-storage facilities for meat, fish, eggs and potatoes. Transport infrastructure has also been upgraded to enable faster and better distribution of food, including imports.

27. 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, stronger, 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.

28. 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; *in vitro* 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.

29. The main strategies of primary health care (PHC) can be summarized by the mnemonic, GOBIFFF: growth monitoring, oral rehydration, breast feeding, immunizations, food supplementation, female education, and food fortification. These are preventative forms of health care.

30. Two disadvantages of the scientific, curative model of health care provision are the cost, many of the treatments are very expensive and involve long-term care, and it does not necessarily reach those who need it most, that is, the

inverse care law, those most in need are less able to afford health care, or have no health insurance.

31. 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.

33. In 2003, the prevalence of diabetes was much higher in HICs compared with LICs. Europe had the highest prevalence (7.5% of the population) whereas sub-Saharan Africa had the least (less than 2.5%). By 2025, it is projected that the prevalence of diabetes in HICs will increase to about 9% (from around 7.5% in 2003) whereas in LICs it will increase from about 4.5% in 2003 to around 6%. Europe still has the largest prevalence, and sub-Saharan Africa the least, but there are major increases in the Middle East, South Asia and Latin America.

Check your understanding

Option G Urban environments

1. The term "hierarchy" means "order" or "importance". A settlement hierarchy could include isolated homes, hamlets, villages, towns, cities, conurbations, millionaire cities and megacities.

2. Functions change over time. Many settlements that were formerly fishing villages have evolved into important tourist resorts. Small market towns may become commuter/dormitory settlements.

3. Factors that influence the location of industrial areas in cities include access to skilled labour, access to the market/CBD, access to good transport routes, room for expansion, and proximity to water for port industries.

4. CBDs generally have high-order retail outlets because it is the commercial and economic core of a city, the area most accessible to public transport, and the location with the highest land values. It attracts the businesses that require the greatest accessibility and pedestrian flows.

5. Two reasons for variations in the pattern of residential land are physical factors and land values. Some wealthier people are attracted to high ground and rivers/canals due to the pleasant views they provide and partly because of the recreational opportunities they offer. In contrast, in some poor countries it is the poor who live close to rivers and areas at risk of flooding. In LICs it is the poor who are forced to live in areas of steep relief, where mass movements may be a risk. In most HIC cities, there is often a pattern of residential location, with the highest residential densities in inner-city areas. Usually, residential density in the city centre is low because of high land values. In the inner city, high-density terraced housing may date from the 19th century. However, with increasing distance from the city centre, residential density decreases. The paradox of the poorest people being located on expensive inner-city land reflects their need to be close to sources of employment. Landlords achieved their profits by cramming as many tenants as they could into these zones. By contrast, wealthier people live in the outer areas, in lower-density housing, where they can commute to work.

6. Some ethnic groups may choose to live close together, and so end up forming neighbourhoods. This is a form of positive segregation, whereby the ethnic group gains advantages by locating in one place: there are enough of them to support services. On the other hand, negative segregation is where certain groups are excluded from certain areas. This might be because of either cost or "red-lining", an illegal process whereby people and authorities prevent ethnic groups from locating in an area.

7. Two advantages of the informal economy are the ease of entry and the labour-intensive nature of the activities. Two disadvantages of the informal economy include the lack of paid leave (paid holidays) and the lack of security.

8. In HICs poverty and deprivation are often concentrated in inner-city areas, or ghettos, whereas in NICs/LICs it is frequently shanty towns that exhibit the worst conditions.

9. Urbanization can be caused by rural-to-urban migration, higher rates of natural increase in urban areas, and/or the reclassification of rural areas as urban areas, as for example with urban sprawl.

10. Gentrification refers to the improvement/upgrading of residential areas, although there is an economic dimension, too. It is common in areas where there may be abandoned industrial buildings, which have potential for redevelopment. Gentrification may lead to the social displacement of poor people: as an area becomes gentrified, house prices rise and the poor are unable to afford the increased prices. As they move out, young, upwardly mobile wealthy populations move in.

11. Suburbanization occurred following the development of transport links, for example, trams and trains. In addition, the price of farmland had declined dramatically and there was scope for urban expansion on a great scale. Rising wages and living standards were matched by rising expectations. Housing was now available and affordable.

12. Counter-urbanization may occur due to dissatisfaction with large urban areas, due to high land prices, congestion, pollution, high crime rates, a lack of community and/or declining services. In contrast, there is a perception that smaller settlements have a closer sense of community, better environments and a safer location.

13. As cities grow, there is increased need to provide access to clean water, sanitation and waste disposal. If these do not keep pace with urban growth, the risk of disease increases, placing further burdens on the city authorities. For many rapidly growing cities, traffic jams, air pollution, unclean water and inadequate telecommunications reflect a failure to match population growth with infrastructure growth.

14. The number of mobile phone subscribers (per 10,000 households) more than doubled between 2005 and 2015, whereas the number of fixed broadband users (although smaller in number) more than tripled. The greatest increase was in mobile internet users, which saw a five-fold increase from 503 per 10,000 households to over 2500 per 10,000 households.

15. Positive deindustrialization occurs when industries reduce their workforce to increase productivity through mechanization and rationalization. This makes the industry more competitive. In contrast, negative deindustrialization occurs when industries decline without any compensating rise in productivity or mechanization.

16. The reasons for the decline in Detroit's population (1950–2013) includes falling car sales and therefore less jobs in the city's large firms; race riots; the oil crisis and the increased cost of motoring; the high number of murders; high pension and social welfare costs and eventually the bankruptcy of Detroit.

17. The formation of urban heat islands is caused by burning of fossil fuels for domestic and commercial use; buildings have a higher capacity to retain and conduct heat and have a lower albedo; urban pollution and photochemical smog can trap outgoing radiant energy; there is a reduction in thermal energy required for evaporation and evapotranspiration due to the surface character, rapid drainage and generally lower wind speeds, and there are lower wind speeds due to the height of buildings and urban surface roughness.

18. There are decreases in relative humidity in inner-city areas owing to the lack of available moisture and higher temperatures.

19. Normal traffic flow in most large cities has an obvious morning and evening peak although there may be prolonged congestion in the largest cities. In contrast, at weekends the TPI pattern curve has smaller but more prolonged peaks, with the morning peak occurring between 7.00 and 1.00 and an evening peak between 14.15 and 19.45.

20. Noise from road traffic and other sources has been associated with raised blood pressure, coronary heart disease, psychological stress and annoyance, and sleep disturbance. Street noise exposure in the USA is believed to account for 4% of the average individual's annual noise dose.

21. The Dharavi slum in Mumbai is a classic example of an area in a prime site for development. Planners want to develop Dharavi into an international business destination. Developers could make a huge fortune from developing the area as a financial or service district. In Rio de Janeiro, the value of land rose threefold between 2013 and 2016, and land speculators bought properties. Average house price increased by 165% between 2012 and 2016. Values rose faster in favelas where the drug gangs were eliminated. Activists claim that the developers have displaced more than 170,000 people, forced out of their homes for games-related purposes. For example, the Favela do Metro, home to 1,000 residents, was destroyed, to make way for parking facilities.

22. There are many reasons for the depletion of green space in Bangalore, such as house building, road widening, new transport infrastructure and a sports stadium.

23. Deprivation can take many forms including low incomes, a lack of employment opportunities, ill health, poor educational achievement, limited access to housing and services, high rates of crime and a poor living environment.

24. The main factors associated with criminal offenders are that they are young, male, single and from broken homes and minority groups. They tend to come from large families, are on a low income, are unskilled and are unemployed. They tend to live in overcrowded, sub-standard rented housing, with a short tenure.

25. Africa

26. Megacities and large cities of 5–10 million are projected to increase in number by 46% whereas small cities of 0.5–1 million are predicted to increase in number by 39% and cities of 1–5 million to increase by 34%.

27. New York is attempting to cut greenhouse gas emissions by 30%; make houses more sustainable; ensure more green space; expand sustainable transport; make energy systems cleaner and more reliable; and to divert 75% of solid waste from landfills.

28. The geopolitical risks that cities face include inter-state warfare, terrorist attacks and political change/riots.

29. The BedZED development has achieved a number of successes compared with UK averages: space-heating requirements are 88% less; hot-water consumption is 57% less; the electric power used is 25% less than the UK average, 11% of it produced by solar panels; mains water consumption has been reduced by 50%; the residents' car mileage is 65% less. Masdar City is planned to be the world's most sustainable eco-city. It is powered by around 88,000 solar panels in a 20 hectare field. It is also connected to the public transport system, and cars are not permitted in the city.

30. BedZED cost around £15 million, which equates to approximately £150,000 per home, which is very expensive. Masdar City will not be completed until around 2030, at a cost of about $22 billion, that is, around $400,000 per resident, which is very expensive.

31. Songdo is 64 km from Seoul and just 11 km from Incheon International Airport, so has excellent accessibility.

32. Some of the characteristics of Songdo City that make it sustainable include TelePresence, which allows video-conferencing from every building. It also reduces the need to travel and thereby reduces Songdo's carbon footprint. All venues are within 15 minutes' walk of Central Park. The city is compact and accessible and contains 25 km of bike lanes. Water conservation measures mean that commercial buildings use 30% less water than average. Information technology enables Songdo to reduce energy loss by 30% as well. Smart meters measure energy consumption and there is micro-generation of wind power and photovoltaics. Plug-in hybrid electric vehicles can buy electricity when it is cheap and store it in batteries in the car.

Check your understanding

Unit 1 Changing population

1. Population distribution refers to where people live and how spread out/concentrated they are.

2. The most favourable conditions for human habitation include fertile river valleys, with a supply of silt and water, good communications, terrain that is not too steep or at high altitude, and a climate that is not too extreme.

3. LEDCs (LICs) are poor countries but are relatively better off than LDCs – the least developed countries.

4. One of the main problems in using classifications of economic development is that many classifications refer to levels of development, which are difficult to define (and to measure). Development should include economic development as well as human development, including standards of living, health, life expectancy etc.

5. The uneven population distribution of China results primarily from the country's physical geography. Only a small proportion can be used for rain-fed agriculture. Much of the western part of the country is characterized by desert, for example, the Gobi Desert, steep slopes of the Himalayas, and the dry grasslands of the north-west.

6. Most of the internal migration within China has been towards the south-east and east of the country, where the major cities and most economic activity are located. In 1990–95 there was some long-distance migration to the western provinces, and some from the north-east of the country to more southern regions. But during 2000–05, most of the migration was from southern and eastern regions, and the main destinations were largely in the south-east and east. The volume of migration increased in 2000–05 compared with 1990–95.

7. The distribution of South Africa's population is very uneven. Some parts of the core economic regions, such as Gauteng province, have population densities of over 1,000 people/km^2, whereas large areas of the Northern Cape Province have densities of less than 5/km^2. High population densities are found in areas where there are good mineral resources, such as gold and diamonds, good farming potential, and good trading potential, such as Durban and Cape Town. In general, the population decreases from the south-east to the north-west. This partly reflects the distribution of rainfall in South Africa: the lowest densities are found in the most arid areas and in parts of the mountain regions.

8. The pattern of forced migration within South Africa during
the apartheid era is very irregular. All of the movements are from South Africa to the "homelands". The homelands are scattered around the eastern side of South Africa, especially around the peripheral parts. Most of the forced migration appears to be away from major cities. Some of the forced migration is short-distance, for example, away from Gauteng province, but much of it is long-distance, for example, from Cape Town.

9. Initially, the death rate is high and fluctuating. In stage 2, it begins to fall rapidly, and then falls more slowly in stage 3. In stage 4 it is low and variable, but rises in stage 5, as the population ages.

10. After the famine in Ireland, the birth rate fell and the death rate rose. This is largely due to the emigration of young adults seeking work and relief from the famine, the consequent ageing of the population, and the high death rate in infants during the famine, leading to further shortages in young people.

11. Total population size is not an indicator of level of development – the other indicators change as development occurs.

12. It is a very crude measure – for example, many people stay on at school after the age of 15 years and many people work after the age of 64 years. Many adults may be unemployed or underemployed, and many women are unpaid carers. The dependency ratios for LICs and HICs may be similar although one has an ageing population and the other has a youthful population structure.

13. Thailand's population pyramid in 1970 is a traditional "pyramid" with a high proportion of children and a very low proportion of elderly. Both birth rates and death rates are high. In contrast, in 2010, the birth rate has declined and the proportion of young is much lower. In addition, the death rate has fallen and the proportion of elderly has increased. Thailand appears to have a demographic dividend in the 2010 pyramid.

14. Germany has an ageing population with a very high proportion of elderly. In contrast, it has a very small proportion of young, indicating a long-term fall in fertility. In contrast, the UAE's population pyramid is dominated by a very high proportion of 25–34-year-old males – reflecting the high level of immigration of young adults into the country.

15. For individuals, megacities offer the prospects of a job, a home and an opportunity to improve their standard of living and quality of life. For societies, having large numbers of people living close together may make it easier to provide housing and health care.

16. There are many problems related to megacity growth, including poverty, unemployment and underemployment, limited access to health care and education, and poor sanitation and access to electricity.

17. A refugee is a "person residing outside his or her country of nationality, who is unable or unwilling to return because of a well-founded fear of persecution due to race, religion, nationality, membership in a political social group or political opinion". IDPs (internally displaced persons) are groups of people who have been "forced to flee their home suddenly or unexpectedly in large numbers, due to armed conflict, internal strife, systematic violations of human rights or natural or man-made disasters, and who are within the territory of their own country". In contrast, an asylum seeker is a person who has left their country of origin in search of protection in another country, but whose claim for refugee status has not been decided.

18. The impacts of forced migration in Syria has led to the mass displacement of millions of people, many of them being forced to live in refugee camps. Most of the refugees live in poverty and are dependent on aid for survival. In Nigeria, some 250,000 people have been internally displaced due to Boko Haram. Sixty per cent of the region's farmers were displaced, leading to less land being farmed and less produce harvested. Over a third of health care facilities were forced to close.

19. Brazil is predicted to see the biggest increase in the proportion of the elderly population between 2010 and 2040, from 6.8% to 17.5%, an increase of 11.7 percentage points.

20. Average household size in some HICs is approaching 2 due to the combination of reduced fertility, divorce and an ageing population. There are many households with a single person, and there are many with just 2 or 3 people, so the overall average is now approaching 2.

21. In 1950, Japan had a youthful population, with a high proportion of young and a small proportion of elderly. The cohort from 5–9 years shows a relative lack of children – those who might have been expected to be born were it not for the Second World War, but there appears to be a post-war baby boom. By 2005, Japan has an ageing population, with a high proportion of elderly and a small proportion of young. The small 5–9 group of 1959 is now a small 60–64 cohort, and the 1950 baby boom is now aged 55–59. The 55–59 cohort have created another large cohort, now aged c. 30–34 years. By 2050, Japan is predicted to have a very old population, with the largest cohort aged around 75–79 years. The youthful population has shrunk dramatically.

22. The challenges associated with an ageing population include the high cost of funding pensions and health care; pressure on nursing facilities; new leisure facilities needed for the elderly; new jobs needed for the elderly; falling demand for schools and teachers; a reduced labour force; an increase in the burden on the working population to serve the dependent population; possible deterioration of the economy; reduced demand for goods from the smaller working population; a need for in-migration to fuel any increase in the workforce.

23. In 1950, China had a population pyramid that was characterized by a high proportion of young and a very low proportion of elderly – a pyramid typical of an LIC. In 1979, at the introduction of the one-child policy, the proportion of China's population that were young had fallen. The 0–4 year cohort was much smaller than the 5–9 year cohort. The proportion of elderly was still quite low. By 2020, China shows a demographic dividend with large numbers of 45–49 year olds and 25–34 year olds. The proportion of elderly is rising, and some people are living into their 80s and 90s.

24. The arguments against the one-child policy include: it is draconian; the fertility rate had already fallen and so the policy was not needed; it has led to a skewed gender balance, with an increase in attacks on women and trafficking in women; it has led to a decline in China's workforce, and from about 2025–30 China's total population will begin to fall, reducing the size of its labour force.

25. The reasons for low fertility in Russia include poor reproductive health care services, a relative lack of modern contraceptives, widespread and unsafe abortions, high divorce rates, an ageing population structure, infertility and women choosing to have fewer children.

26. The measures to increase the birth rate in Russia included an increase in pregnancy, birth and child benefits based on the number of children a family had; increased parental leave following the birth of a child and increased payments to mothers of second and third children.

27. There is a tradition of female employment, with girls educated to the same standard as boys. There is open access to universities and colleges where women often study to be doctors and nurses. Employment opportunities have been open to women in health and education since the early 20th century. Women in Kerala have a longer life expectancy than men there.

28. Women are marginalized in the economic process and have a lack of control over resources. The work participation rate for women is just 18% compared with 53% for men, and women are concentrated in low-paid jobs such as farming, cottage industries, domestic services and informal economies. Women's role in decision-making is limited; the legal system, for example, s male dominated. Violence and sexual harassment against women is still common, much of it related to their husbands' alcohol consumption.

29. Population groups at increased risk of trafficking include refugees and migrants; lesbian, gay, bisexual, transgender and intersex (LGBTI) people; religious minorities; people with disabilities and those who are stateless.

30. Human trafficking occurs in most countries, and is often a transborder phenomenon. In the past, trafficking may have been more likely between two nations, whereas now it is more likely to be a multinational phenomenon.

31. South Korea has a population pyramid in 1950 which is characteristic of an LIC – a high proportion of young, and a low proportion of elderly, suggesting high birth rates and high death rates. By 1979, South Korea still has a high proportion of young – and the largest cohorts are children aged 5–9 and 10–14 years, but the 0–4 cohort has declined in size. By 2020 South Korea's main cohorts will be those between 45 and 55 years, that is, working adults.

32. The demographic dividend does not last because over time the adult population ages and retires, and is no longer productive but is more of a drain on resources than a creator of resources.

Check your understanding

Unit 2 Global climate – vulnerability and resilience

1. The amount of solar energy that is reflected back to space is 31%.

2. The proportion of solar energy that reaches the Earth's surface is 46%.

3. Nimbostratus clouds greatly reduce the amount of solar radiation that is received at the surface. When the Sun's angle is high, typically about 150 watts/m^2 are received (15% of solar radiation). When the Sun's angle is medium, about 10% of the solar output is received, and when the Sun is low in the sky it is down to 5%. In contrast, high altitude cirrus (ice) clouds are not as thick or as dense, and allow between 65% of solar radiation when the Sun is high and about 40% when the Sun is low.

4. Most of the incoming solar radiation is concentrated in the 0.1–0.2 wavelength (μm) whereas most of the terrestrial radiation is in the 0.5–50 wavelength (μm) with a peak at around 3 μm.

5. The greenhouse effect is the process by which certain gases (greenhouse gases, such as water vapour, carbon dioxide and methane) allow short-wave radiation from the Sun to pass through the atmosphere but trap an increasing proportion of outgoing long-wave radiation from the Earth. This radiation leads to a warming of the atmosphere.
6. The Keeling curve shows how atmospheric carbon dioxide has risen from around 315 ppm in 1950 to over 400 ppm in 2015 (an increase of over 25% in just 65 years), and is predicted to rise to 600 ppm by 2050.

7. The eruption of Mount Pinatubo lead to a sudden global decline in temperature of about 0.3°C in 1991–92. The decline in mean temperature fell from about 0.15°C to 0.1°C by 1997 and continued until at least 2005.

8. Polluted air contains far more particles than clean air, such as ash, soot, sulphur dioxide. It provides many more surfaces for water to bind to. The droplets formed tend to be smaller than natural droplets, which means that polluted clouds contain many much smaller water droplets than naturally occurring clouds. Many small water droplets reflect more sunlight than fewer larger droplets, so polluted clouds reflect far more light back into space, thus preventing the Sun's heat from getting through to the Earth's surface and leading to global dimming.

9. An example of a terrestrial albedo change and its associated feedback loop occurs with the melting of snow and ice. As air temperature increases, there is increasing melting of ice caps and snow-covered areas. This replaces a highly reflective surface with a darker surface (albedo change), which absorbs more solar radiation, and reinforces the rise in temperature.

10. Global dimming could be regarded as a form of negative feedback. The use of fossil fuels can lead to increased temperatures due to more carbon dioxide in the atmosphere. However, the increased volume of pollutants in the atmosphere, provides many more smaller pollutants for water to bind to. The increased number of water droplets reflects more sunlight and so reduces the rise in global temperature.

11. The main contributors to greenhouse gas emissions are carbon dioxide (77%), methane (14%), nitrous oxide (8%) and HFCs/PFCs (1%). The main sources of CO2 include deforestation, road transport, residential buildings and commercial buildings. The main source of methane includes livestock and manure landfill, waste water and rice cultivation. The main source of nitrous oxide is agricultural soils.

12. The top ten contributors to greenhouse gases are all HICs and/or NICs. The top ten contributors includes the EU, so there are actually 37 different countries involved. China and the USA account for over one-third of all emissions, and the rest of the 35 countries another one-third. LICs contribute a relatively small amount (less than 25%) of global greenhouse gas emissions.

13. Global warming is expected to lead to an increase in extreme weather events, and changes in long-term weather and climate patterns.

14. Sea level is likely to rise due to the steric effect, that is, the expansion of warmer water molecules, and the melting of ice caps and/or ice sheets transferring water from ice into the seas/oceans.

15. Annual trends show a peak in March (winter–spring) and a minimum in September (summer–autumn), hence the erratic profile of the curve. The long-term trend is that the extent of the sea ice is declining, from around 8 million km^2 in 1978 to around 5 million km^2 in 2014.

16. In all time periods, the peak extent of Arctic sea ice is during March. In contrast, the minimum occurs during September. The largest monthly totals were generally in 1979–88, whereas the minimum monthly values were between 2009 and 2012.

17. It is believed that 30–40% of the global soil carbon storage is contained within periglacial soils. As global warming melts periglacial areas, there will be a release of carbon stored in the soil, and this will lead to an increase in atmospheric CO_2, thereby contributing to global warming and increased melting of periglacial areas.

18. By suppressing wildfires, humans prevent carbon from entering the atmosphere and allow carbon to build up in plants instead. However, the use of fire to create new farmland releases considerable amounts of carbon into the atmosphere.

19. Even keeping global warming to a 2°C increase, there is a risk of heatwaves occuring each year. The Amazon rainforest could become grassland or desert, and the oceans may become too acidic for coral. More than 60 million people will be at increased risk of malaria, and up to half a billion people will be at risk of starvation.

20. Due to global warming and increased atmospheric energy, an increase in storm activity is likely, such as more frequent and intense hurricanes. More evaporation will occur over oceans, providing more energy for tropical storms, resulting in more rising air, lower pressure, and more intense storms.

21. Due to global warming, there is likely to be a shift in biomes from low latitudes to high latitudes, and a shift up slopes (an altitudinal shift) such as on mountains.

22. Barriers to migration include rivers, oceans, mountains and human environments such as urban areas and industrial zones. A lack of suitable corridors may prevent some species from migrating.
23. Mosquitoes would be able to breed in areas previously too cool for them, and so will move into higher latitudes and altitudes. The same is true for other tropical diseases.

24. Some communities are already claiming to be environmental refugees, forced to leave their homes as a result of sea level rise caused by global warming. Residents of low-lying islands such as Kiribati in the South Pacific have abandoned their homes. In Bangladesh 65% of the labour force is involved in agriculture that is threatened by floods in low-lying areas. Coastal flooding, caused by the melting of the polar ice caps and the thermal expansion of the oceans, will particularly affect countries that have land below sea level, such as the Netherlands, and may lead to economic and social stress due to loss of land and resources, and possibly lead to forced migration.

25. Population groups that are vulnerable to climate change include the very young, the elderly, those with disabilities, the poor, minority groups, refugees and indigenous people. Carers, who are generally women, are also vulnerable, because of their burden of caring for the young, the elderly and the sick. Single-parent households are often very vulnerable to climate change as they may combine a number of at-risk characteristics, such as age, gender and poverty.

26. Indigenous people often experience socio-economic problems such as low incomes, poor health and limited access to resources, including water. These factors make them vulnerable to climate change. Most indigenous populations have adapted their lifestyles to their environment, and they are therefore vulnerable to any changes in that environment. The Inuit people in the Mackenzie Basin in Canada have experienced a rise in temperature of about 3.5°C since the 1980s, which has caused permafrost to melt, changing the ecosystem and leading to an increase in landslides and forest fires, and reduced water availability. Wildlife in the Basin is a major source of food, clothing and income. However, the muskrat, once a major economic activity, has disappeared. Many Inuit have had to abandon their traditional lifestyle.

27. Three potential impacts of climate change include flooding in the main river basins; rising sea levels will lead to coastal flooding; and monsoon rainfall is predicted to increase 14–40% by the 2030s and 52–135% by the 2090s.

28. Out-migration of men, more illnesses and declining water supplies are likely to increase the pressure on women. Women may have to find more paid employment to help with the family income/do even more of the work on the farm; women are the main carers and so the burden of looking after the ill will fall on women; women and children are the main collectors of water, so as water supplies diminish they may have to travel further to collect water, putting themselves under greater physical and mental stress.

29. Adaptation refers to initiatives and measures to reduce the vulnerability of human and natural systems to climate change. In contrast, mitigation refers to attempts to reduce the causes of climate change.

30. The Kyoto Protocol aimed to reduce greenhouse gas emission by 5% of the 1990 levels. However, not all countries agreed to this, notably USA, China and Australia. In contrast, the Paris Agreement does not specify country goals, methods, nor a detailed timetable. 174 countries agreed to limit global warming to 2°C, as soon as possible, but there is no mechanism to force countries to do so, or to penalize them if they fail.

31. The main constraints in attempts to introduce climate mitigation strategies include cost, technical feasibility, lack of support (inconvenient for industry and for customers/users), no real desire amongst certain groups, for example, energy lobby, climate change deniers, and it requires global cooperation to be effective.

32. Carbon taxes are taxes that are imposed relative to the proportion of carbon burnt (they are rather like water meters). These taxes would be most effective if they were applied internationally, but could be valuable nationally. CO_2 imposes high costs on society but those who emit the CO_2 do not pay for the social costs that they impose. A "carbon tax" of $25–$100 per tonne, equal to the social cost of the CO_2 emitted by the fuel would raise the costs of coal, oil and gas compared with wind and solar, for example, thereby shifting energy use towards the low-carbon options.

33. The WWF is attempting to tackle climate change by increasing pressure on governments, companies and individuals, and through educating them, for example, to reduce greenhouse gas emissions, to reduce the use of fossil fuels and to conserve forests, to work towards 100% renewable energy by 2050, to reduce emissions from aviation, and to encourage people to use new technologies, have greener lifestyles and to call for climate-smart legislation.

34. Some corporate strategies have helped to address global climate change. When Vodafone took the WWF-UK's One in Five Challenge, it invested £600,000 in video-conferencing facilities, which resulted in 320,000 km less business travel, a reduction in the number of business flights from 14,379 to 10,630 km and it reduced its CO_2 emissions by 617 tonnes. The company saved about one-third of its previous costs of air travel. On the other hand, many companies, particularly in the USA, and many US citizens do not want their government to pursue policies that they feel would lead to a decline in US competitiveness and job losses.

Check your understanding

Unit 3 Global resource consumption and security

1. The middle class is defined as anyone living on at least $4/day.

2. Most of the middle class will come initially from Central and South America. However, from around 2020 until 2050, the majority of the middle class will originate in the Asia Pacific region.

3. Most components of the EFP increased very gradually, for example, grazing, fishing, built-up areas and forests. In contrast, there was a rapid increase in carbon consumption, and a smaller increase in the use of cropland.

4. HICs have a higher ecological footprint than either MICs or LICs. In turn, MICs have a higher ecological footprint than LICs. The composition is broadly similar in HICs and MICs; carbon makes up the largest contribution, followed by cropland and forest products. Built-up land accounts for the lowest contribution. In contrast, in LICs, forest products account for a higher relative amount, although this decreased between 1961 and 2012, and carbon is beginning to account for a larger proportion, although it is still relatively low.

5. HICs use most of their water (59%) for industrial uses, followed by agriculture (30%) and domestic uses (11%). In contrast, LICs use most of their water for agriculture (82%), followed by industry (10%) and domestic uses (8%).

6. Virtual (or embedded) water is the way in which water is transferred from one country to another through its exports.

7. Land availability/person has declined in many areas due to a combination of rapid population growth, land-use changes that is, non-agricultural land-uses, pollution/degradation of the land, and land grabs by foreign companies. In addition, climate change is making some land unsuitable for cultivation (too dry, too salty) and so the amount of land available is declining but the population is rising.

8. Growth rates of food production and crop yields have been falling due to natural hazards (fires, floods, drought), global climate change, the use of land to produce biofuels, land degradation (falling fertility, salinization, desertification etc.).

9. The largest increases in fuel sources between 2020 and 2030 is projected to be fossil fuels (gas, coal and oil). This will account for nearly 600 TJ out of a total of c. 700 TJ. Although there has been an increase in biomass and other, it still only accounts for a small overall percentage. Hydro and nuclear show very little change.

10. Energy insecurity has increased for many reasons, including greater demand, especially from newly industrializing countries (NICs); reserves of some fossil fuels are declining as supplies are used up; geopolitical developments have taken place, for example, countries with oil resources such as Russia have been able to "flex their economic muscles" in response to the decreasing resources in the Middle East and the North Sea; global warming and natural disasters such as Hurricane Katrina (2005), have increased awareness about the misuse of energy resources; terrorist activity such as in Syria, and the conflict between Russia and Ukraine, have all had an impact on energy security.

11. The nexus refers to the interrelationship, interdependence and interactions between water, food and energy.

12. Just as demand for food affects demand for water, water policy may affect what can be grown. Demand for food also influences demand for energy, while energy policy affects how much energy can be used in agriculture. Energy policy influences how much water is available for other sectors, and the use of water determines how much can be used by the energy sector.

13. Demand for water is increasing in the Hindu Kush Himalayan region of South Asia due to a combination of population increase, demand for agriculture, demand for energy and increasing demand for industrial uses.

14. The increase in the pumping of groundwater requires large amounts of energy, which reduces the availability of energy for other sectors.

15. South Asia has a major problem with food production because about 25% of the world's population live there, on just 3% of the world's available land. In addition, nearly half of the world's poor and over one-third of the world's malnourished population live in South Asia.

16. Per capita amounts of arable land in South Asia are declining due to a combination of population growth, urbanization (taking some of the best quality land), increasing demands for biofuels, land degradation and climate change.

17. Already a very high proportion of the population use biomass as an energy source. Sources may become depleted due to overuse or increasing demand. In addition, more land is being used for biofuels, and there is increased demand to use the land for other projects. Biomass may become scarce and poor people, in particular, may be unable to afford the price of alternative fuels.

18. It may be difficult to develop HEP resources in Nepal due the high incidence of landslides. This could trigger a lake/reservoir burst/overflow. In addition, the weight of the reservoir could trigger earth tremors in the region, which is seismically active.

19. Advantages of desalinization include the plentiful supply of seawater, and the projects that would benefit from increased access to freshwater. However, it is very expensive to operate, and it requires much energy, which releases greenhouse gases.

20. Increasing the supply of renewable energy would increase the amount of energy available and reduce the amount of greenhouse gas emissions. It would also require less water than thermal power stations, which require large amounts of water for cooling purposes.

21. "Remove" is considered to be the best form of waste management because if the demand for a product disappears (is removed), no product will need to be manufactured/produced, and there will be no waste product to dispose of.

22. Two positive aspects of the disposal of e-waste in Guiyu, China 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.

23. Malthus had a very pessimistic view about population and resources. He believed that there was finite optimum population size in relation to food supply, and that any increase in population beyond this point would lead to a decline in the standard of living and to "war, famine and disease". The neo-Malthusians were also pessimists. They believed that population would outstrip resources, but they argued in favour of family planning as a way of reducing population growth.

24. According to the Limits to Growth model, the five factors that limit growth on Earth are population growth, agricultural production, the decline of natural resources, industrial production and pollution of natural resources.

25. In model 4, the carrying capacity increases, allowing population to increase, whereas in the other models there is a set limit to carrying capacity.

26. Carrying capacity can be increased through intensification of agriculture using irrigation, terracing, wetland drainage, high yielding varieties and chemical fertilizers. These will increase yields allowing more people to be supported.

27. Resource stewardship is a concept that suggests that humans can use resources in such a way that they will be available to future generations. Not only will there be environmental sustainability but also social equity over access to resources.

28. Optimum population is the number of people who, when working with all the available resources, will produce the highest per-capita economic return. It is the highest standard of living and quality of life.

29. 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.

30. Only about 15% of phones are currently collected and recycled. Increasing collection rates to 50% would make a huge difference: second-hand sales of phones would be profitable even after collection, processing and remarketing. Collecting reusable components and remanufacture could be made easier if the design of certain parts of a phone were standardized. The main parts that could be remanufactured include the charger, battery, camera and display. Recycling of phones would generally occur close to the market and result in reduced imports of phones.

31. Sub-Saharan Africa has high rates of poverty, food insecurity and most new cases of malaria/HIV.

32. Better education and more skills would allow children/young adults to get a better job, a skilled job, with greater pay. This should give them a better standard of living, and an ability to afford better housing, a healthy diet and greater access to clean water and sanitation. It should improve their quality of life.

Check your understanding

Unit 4 Power, places and networks

1. The highest levels of globalization are found in HICs, in particular north-west Europe, Canada and Australia. The lowest values are found in parts of East Africa, south and central Asia. Much of Africa and Asia have relatively low levels of globalization.

2. Two ways in which the New Globalization Index differs from the KOF Index are that it measures the distance of goods traded, thus New Zealand and Argentina score higher on this measure than, for example, Hungary and the Czech Republic. Secondly, it counts the number of refugees in a country; hence Lebanon and Turkey would appear to be more globalized.

3. Soft power describes the ability to change individuals, communities and nations without using force or coercion.

4. The USA has a larger economy, $17 billion as opposed to $10 billion, and its GNI/person is much higher than that of China.

5. Being small in number, it is able to reach decisions; however, it only represents a small proportion of the world's population/does not represent poor countries.

6. There are no African countries represented in the OECD and very few from South Asia. There is a limited number of countries from South America. Some of the member countries are very small, for example, Iceland and Latvia, whereas other countries with very large populations, such as Brazil, India and China, are not represented. At present, it is mainly rich countries that are represented.

7. 80–82%.

8. They are mainly located in the MENA region (nine out of fourteen countries), mainly in the Middle East (6), followed by Africa (5), and a further two in South America and one in south Asia. They are all within the Tropics.

9. One advantage of the IMF is that member states with balance of payment problems may request loans to help fill gaps between what they earn and/or are able to borrow from other official lenders. However, they may be forced to accept structural adjustment programmes (SAPs), for example, have to sell as much of their national assets as they can, normally to western corporations at heavily discounted prices, or increase taxes/reduce benefits even when the economy is weak – in order to generate government revenue/reduce spending.

10. One advantage of the New Development Bank is that much of the lending will be for infrastructure and sustainable development projects, such as clean energy, within member states. However, there is only $100 billion available, which the bank says is insufficient to meet the infrastructural development needs of emerging economies.

11. Europe's share decreased from around 45% of world trade in 2005 to around 40% in 2015, whereas Asia's increased from about 25% in 2005 to around 35% in 2015. All other regions remained relatively similar.

12. In developed economies the most important services were Other business services (23%) followed by Travel (20.6%)
and Transport (17%). Other important services included Financial (11.2%), Telecommunications (9.1%) and Intellectual property (8.9%). In contrast, in developing economies, Travel was the most important service (36.5%), followed by Transport (20.2%) and Other business services (20%). Financial services accounted for just 4.1% and Intellectual property 1.1%.

13. Two advantages of top-down development are that it is often well funded and quickly responsive to disasters. Two advantages of bottom-up development are that it is labour intensive and it involves local communities/local areas.

14. Due to debt relief, Tanzania was able to introduce free schooling, build more schools and employ more teachers. However, critics of debt relief state that it does not help the poor, that it does not help countries that do not get into debt, and that it encourages countries to overspend.

15. The main flow of global remittances is from HIC to LICs, for example, the flow from USA to Mexico is worth over $20 billion/year, and the flow from the UAE to India is worth around $14 billion. The Middle East is a major source of remittances
(> $40 billion) as are other HICs, for example, UK, Canada, France and Germany (all around $20 billion or more). Major recipients include India (> $35 billion), Mexico ($23 billion) and China ($23 billion).

16. Remittances go directly to the household, who can decide how to spend it.

17. Trade in counterfeit food and drink and fraudulent medicine is dangerous as it may be contaminated/unsafe, medicines might not "work", governments lose out on tax payments, and there may be extra costs with surveillance/policing.

18. The main flows of cocaine are from the Andean region of South America through Central America and into Mexico and the USA. Another major flow is from the Andean region through Venezuela and into Europe, some of it via the Caribbean. There are smaller flows from South America into West Africa and Southern Africa, and then on to Europe.

19. One potential advantage of FDI is cheaper imports into HICs of relatively labour-intensive products that keep the cost of living down and lead to a buoyant retailing sector. Another is the growth in employment in LICs in relatively labour-intensive manufacturing spreading wealth.
20. A disadvantage of FDI is that job losses are invariably concentrated in certain areas and certain industries within HICs. This can lead to deindustrialization and structural unemployment in certain regions. In LICs, TNCs can be very exploitative and establish sweatshops/poor working conditions.
21. The Tata Group provided a company town for its workers, introduced an eight-hour working day, and paid leave. More recently it has become committed to "frugal innovation", that is, new products designed for poor people, such as the Tato Nano, a cheap water filter, and a $500 house.
22. Apple chose Foxconn as its principal supplier partly because China has actively encouraged inward investment from overseas TNCs. Working conditions are poor, including low pay and long working hours. This reduces costs for TNCs such as Apple. Moreover, Chinese labour laws do little to protect workers, and so workers are more likely to accept the working conditions. Thus goods are produced for Apple at relatively little cost to the company.
23. Free trade areas are where members abolish tariffs and quotas on trade between themselves but restrict imports from non-member countries. NAFTA is a good example of a free trade area. In contrast, customs unions are a closer form of economic integration. As well as having free trade between members, all members operate a common external tariff on imports from abroad. Mercosur is a good example of a customs union. Common markets are customs markets which, as well as the free trade in goods and services, allow free movement of people and capital.
24. Most of the trade in North America involves the USA. For example, exports to the USA from outside of North America amount to nearly $1,500 billion, compared with exports to Canada and Mexico of less than $250 billion. US exports to outside of North America are over $1,000 billion, whereas the joint exports of Mexico and Canada are less than $200 billion. Both Canada and Mexico export more to the USA than they import from the USA. The exports/imports between Canada and Mexico are relatively small in comparison.
25. Migrants have a higher representation in unskilled jobs such as labourers (7.9%) and assemblers (13.4%) compared with native-born US citizens (3.7% and 8.8% respectively). In contrast, native-born citizens are far more likely to be employed as managers (15.5%) and high-level sales (7.2%) compared with migrants (7.0% and 3.2% respectively).
26. Migration has become more global, is accelerating in scale, has become more varied, and there are more women migrating. Recent political events in the USA and in much of Europe have attempted to slow migration, restrict the movement of particular groups of people, for example, some refugees and some Muslim populations, and to construct barriers, for example, the "wall" between Mexico and the USA and various fences in Europe.
27. The "shrinking world" means that it takes less time to travel between places, and it is possible to communicate in an instant between some faraway places. However, not all of the world shares the same level of interconnection.
28. The volume of cross-border data flows has increased by a factor of 45 between 2005 and 2014. For example, in 2005 the bandwidth between North America and Europe was 500–1,000 Gbps (Gigabits per second). In 2014 it had increased to over 20,000 Gbps. Similarly, in 2005 the flow between North America and both Latin America and Asia was 100–500 Gbps. By 2014 these had both increased to between 1,000 and 5,000 Gbps. The volume of data flows from Europe to Africa and Asia increased from less than 50 Gbps in 2005 to 1,000–5,000 Gbps in 2014.
29. The frictional effect of distance, or distance decay, suggests that areas that are close together are usually more likely to interact with one another, whereas areas far apart are less likely to interact with one another.
30. Containers are essential for the modern global economy. About 90% of non-bulk cargo worldwide is transported in containers stacked on trucks, rail wagons and freight ships. Many of the larger container ships can now carry 17,000 TEUs (20 foot equivalent units) and there are plans to build containers that can carry 25,000 TEUs, but the number of ports that can accommodate these ships is limited.
31. The greatest access to the internet (> 65.4 users per 100) is largely in HICs in North America, Europe, Japan, South Korea, Australia and New Zealand. There are some exceptions such as UAE, Malaysia and Chile. The lowest users (<12.25 per 100 users) are largely in sub-Saharan Africa, but there are exceptions such as North Korea, Afghanistan, PNG, Cuba. In general Africa and South Asia have the least access to the internet.
32. The greatest access to mobile cellular subscriptions (> 139 per 100 users) is very varied and includes parts of North Africa, southern Africa, south-east Asia, South America and Russia. However, the least access (44 per 100 users) is found in north central Africa, Cuba and North Korea. Low access (44–85 per 100) is found through much of Africa, south Asia, Canada and Mexico. Relatively high rates (113–139/100 users) are found in much of South America, Australia, south-east Asia, parts of north-west Europe and in parts of the MENA region.
33. Landlocked countries face major problems for economic development. Increased transport costs and times may reduce access to markets. Countries may also have to pay substantial tariffs to export their goods. For example, South Sudan has to pay either Sudan or Kenya to get its oil to the coast. Landlocked countries may also have to pay for the use of another country's air space.
34. Countries use the wealth from exporting their raw materials to diversify and produce a more broadly based economy. In South Africa Johannesburg developed around the exploitation of gold and Kimberley developed due to diamonds. Many countries in the past developed because they had substantial coal deposits, oil, or other valuable mineral resources.

Check your understanding

Unit 5 Human development and diversity

1. It helps prevent the spread of infectious disease, such as diarrhoea and cholera. Clean water is important for drinking, cooking, washing, cleaning etc.

2. Evidence that many children have a poor quality of life include the fact that 10% of the world's workers and their families are living on less than $1.90/day. Nearly 6 million children died, mostly from preventable causes. Nearly 60 million children of primary school age did not attend school. Many children experience water stress, and live in households that do not have access to electricity. Finally, at its peak, over one-third of victims of trafficking were children.

3. There are very high HDIs in HICs in western Europe, North America, Japan, South Korea, Australia and New Zealand. Anomalies include Argentina and Saudi Arabia. There are high HDIs in much of Central and South America, eastern Europe and Asia. Low HDIs are found in sub-Saharan Africa (excluding southern Africa) and in some locations in south Asia.

4. The highest inequalities are found in parts of West Africa and Central Africa and in some parts of South Asia. Gender inequalities are lowest in HICs such as Canada, Australia and many western European countries. Anomalies include China and Libya. Most of Africa, South Asia and South America has moderately high rates of gender inequality.

5. Colombia has made much progress in the empowerment of women. For example, in 2011, 32% of cabinet members were women, up from just 12% in 1998. Girls' enrolment in secondary and tertiary education exceeds that of boys, and women's participation in the labour force increased from 30% in 1990 to over 40% in 2012.

6. The International Fund for Agricultural Development (IFAD) established a sustainable rural development project for the Ngobe–Bugle Territory to define territorial boundaries and restore land rights to the indigenous communities. It provided financial and technical support to the communities involved, and improved local leaders' planning and administrative skills. The ultimate aim of the project is to support natural resource management based on traditional practices.

7. Microfinance schemes often focus on women, who in some societies are unable to own land or borrow money. In most microfinance schemes, the members are part of a community, and the community lends out money to its members. This makes repayment of the loan much more likely.

8. Microfinance schemes have interest rates that are higher than those of commercial banks but lower than those of loan sharks; some people will use the loans to pay for food or health care rather than for starting or improving their business; not all poor people are entrepreneurs and so the loans may be wasted; microfinance loans may be used to pay off other loans rather than for business purposes; microfinance does not necessarily tackle the root causes of poverty but may make poverty worse.

9. Fair trade aims to ensure that producers in poor countries get a fair deal. A fair deal includes a fair price for goods and services, decent working conditions and a commitment from buyers so that there is reasonable security for the producers.

10. Fair Trade is concerned with the working conditions of workers. It promotes fair wages, prompt payment, a safe and healthy working environment, and proper treatment of any children that may be working. It promotes equality of employment for all.

11. Corporate social responsibility (CSR) refers to the attempts of companies to assess the social, economic and environmental impacts of their activities, and take action to reduce these impacts if necessary.

12. According to the Worker Rights Consortium, a pressure group, audits had looked at working hours and child labour, but not the structural soundness of buildings or fire exits. Local police had warned that the building was unsafe but the owners allegedly threatened to fire those who did not carry on as usual. The government was criticized for not enforcing building regulations – some two dozen factory owners are members of Bangladesh's parliament. Planning permission had been given for a five-storey building, not an eight-storey building.

13. Culture gives us a sense of "who we are" and where we belong. It gives us a sense of our own identity and how we identify with others. Culture is a process rather than a thing, and it is constantly shifting and changing rather than fixed. It is a complicated concept with a range of meanings, and it is important to all human populations. Culture is the way of life of a particular society or group of people. Among other factors, it includes beliefs, behaviours, customs, traditions, rituals, dress, language, art, music, sport and literature.

14. There is much in-migration of people from other places/countries who are attracted by the prospects of jobs/better standard of living. They bring with them lots of new ideas/innovations and part of their heritage (culture) from a variety of locations.

15. Cultural diffusion, the spread of cultural traits, occurs in many ways. It may occur when two cultures intermingle, which occurred historically when members of different cultures interacted with one another through trade, intermarriage or warfare, and it happens today when, for example, different countries share an interest in a particular sport. Cultural diffusion may also be forced, as when one culture defeats another and forces its beliefs and customs on to the conquered people.

16. It used to be the case that the cultural imperialist was a large, economically or militarily powerful nation (like Britain during this period) and the victim country was a smaller or less affluent one (like India). However, the end of formal colonialism in the second half of the 20th century did not spell the end of cultural imperialism. Today, however, global cultural imperialism today has resulted from economic forces, as when the dominant culture (usually the USA) captures markets for its commodities and thereby gains influence and control over the popular culture of other countries. Some of the means by which this happens occur through language, tourism, global brands, the media and democracy.

17. Glocalized products adapt to a local market, so they are more acceptable and therefore local people are more likely to buy them, for example McDonald's green tea-flavoured milkshakes in Japan!

18. Hydribized commodities develop as an attempt to take over the market share of an external product. They are more "local" in their appeal, and try to replace popular, globalized products, such as Zamzam (cola) replacing Coca-Cola in Iran and the Middle East.

19. 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 seen in different areas of the world. Many cities have pedestrianized shopping centres, open markets and out-of-town supermarkets. Many large cities have China towns and other ethnic or racial areas.

20. 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; the development of "smart cities"; improvements in ICT and the desire to be seen as "developed".

21. Diaspora refers to the scattering/migration of a population outside of their native homeland.

22. Migrants bring their culture with them. Many migrants intermarry and create new hybridized groups, for example, the Jawi Peranakama and the Straits Chinese Peranakam in Singapore.

23. Two advantages of locally produced goods include reduced air miles and smaller carbon footprint. Two advantages of globally produced goods include the ability to produce foods cheaply and to a uniform standard, and cheap food available year round.

24. Campaigns against TNCs have developed as many people believe that they are exploiting people in LICs, exploiting women and children, exploiting and sometimes wasting resources, and causing pollution.

25. Austria Freedom Party 35.1%

26. Denmark has introduced a points system designed to make it more difficult for "family reunions" that allow foreigners into the country for marriage, imposing a minimum age of 24 years for both the Danish spouse and the immigrant, proof of financial independence, and evidence of an active commitment to Danish society. In 2016 the Danish government voted in favour of seizing asylum seekers' assets in order to help pay for their stay while their application for asylum is considered.

27. Eritrea experiences human rights violations, widespread detention and indefinite military service. Fearing the spread of uprisings following the Arab Spring, Eritrea scrapped plans for mobile internet access for its citizens. The internet is available only through slow dial-up connections, and less than 1% of the population go online. Some Eritrean exiles try to provide independent online websites and broadcasts, although these are blocked by the state-run telecommunications company, EriTel. Most Eritreans in national service earn just $1–$2 per day.

28. North Korea generally prevents its population from travelling around the country or abroad, and only the political elite own vehicles. Emigration and immigration are strictly controlled. Only political supporters and the healthiest citizens are allowed to live in Pyongyang. Less than 10% of the population have cellphones. Some schools and other institutions have access to a highly-controlled intranet. Radio and TV sets bought in North Korea are only able to receive government frequencies.

29. The US, Russia and India.

30. Resource nationalism may provide a larger share of the profits from resource development. However, the state must be prepared to help out those industries when they face tough times. It is important for the countries to give companies enough return on their investments that they will continue to invest in the future.

31. Civil society refers to any organization or movement that works in the area between the household, the private sector and the state to negotiate matters of public concern. Civil societies include non-governmental organizations (NGOs), community groups, trade unions, academic institutions and faith-based organizations.

32. Social media has brought gender equality and women's rights issues to the forefront of both policy-making and media attention, including areas such as bringing women's issues to the forefront of political agendas, tackling violence against women through social media tools, and, public accountability towards gender equality.

33. The Rohingyas became stateless in 1982, and in 2014 the state expelled humanitarian groups, thereby preventing health care and aid for the Rohingyas, who also suffered human rights abuses.

34. The countries in which the Arab Spring was successful had strong civil societies, widespread coverage on television greater access to social media, support of the national military and the mobilization of the middle class.

Check your understanding

Unit 6 Global risks and resilience

1. The increase in ownership of phones, laptops; more parts of peoples' live are carried out online; and more computer-literate criminals are able to exploit cyber-crime.

2. Governments may use surveillance to check for terrorist activity; they may also use surveillance to spy on people and thus infringe their human rights.

3. Physical environmental factors include natural disasters (earthquakes, floods), extreme weather events and epidemics. Floods in Bangladesh regularly disrupt the supply chain there, making it difficult to transport goods and raw materials within and from the country. The 2011 tsunami that affected Japan had a major impact on the motor industry: up to 150,000 fewer cars were produced in the USA as a result of disruption of the supply chain for parts.

4. Political factors include protectionism, trade restrictions, and conflict, all of which have a major impact on the supply chain. Supplies of goods from the Middle East and North Africa were severely disrupted at times following the Arab Spring protests. Governments with poor political or economic stability may take decisions (such as resource nationalism) that cause much uncertainty among investors.

5. Highest is Malta; lowest is Bulgaria.

6. The European Commission ruled that the tax deal between Apple and the Irish government was illegal, since the same deal was not open to other companies. Irish corporation tax is normally 12.5%, one of the most competitive in Europe, but Apple had an arrangement whereby the maximum tax rate it paid in Ireland was just 1%; in 2014 it paid a mere 0.005%.

7. Drones have a number of advantages: they can be used for surveillance in natural and man-made disasters to survey damage, locate victims, help the police search for lost children and monitor large crowds. However, they have been linked with an invasion of personal privacy. Their powerful cameras and remote sensing imagery can be used to "spy" on people. Other problems include cost, especially with the drones used for military operations, breakdown or malfunction of computer software, and human error in their operation.

8. 3D printing has been used to create prosthetics, parts of the human body, organs and tissues. It has been used to create a 5 cm long blood vessel and an eagle's beak destroyed by a hunter. However, 3D printing technology has disadvantages.
   The lack of legislation and regulations concerning the technology means that it can be used to create weapons, parts of weapons, guns, knives and counterfeit goods.

9. Renewed nationalism may lead to protectionist policies such as trade barriers, policies favouring domestic workers, anti-immigration measures and resource nationalism.

10. France and Austria are the two countries with most populist measures.

11. The two main chemicals that cause acid rain are sulphur dioxide and oxides of nitrogen.

12. There are a number of impacts of acidification including: weathering of buildings; mobilization of metals, especially iron and aluminium, which are flushed into streams and lakes; aluminium damages fish gills; reduction of forest growth; soil acidity increases; lakes become acidic and aquatic life suffers; and there are possible links (as yet unproven) to the rise in cases of senile dementia.

13. Shipping contributes to many negative impacts on the natural environment. For example, oxides of sulphur and nitrogen trigger early rainfall over oceans, and severe droughts may occur over land; there is warming and acidification of the oceans, leading to jellyfish invasions; particulate matter carried in ships' exhaust gases scatter and absorb solar and thermal radiation causing increased rainfall in the area of the shipping lanes; soot-infused snow contributes to Arctic warming and decline of ice cover.

14. Pollution by shipping is most intense in areas where shipping is concentrated into narrow zones, such as in the Indian Ocean between Singapore and Sri Lanka, and others in the Red Sea, the Gulf of Aden, the Mediterranean Sea and along the route from Singapore to China. Such tracks are less evident in the Pacific and Atlantic Oceans, where ships are not concentrated in narrow zones.

15. The main flows of carbon associated with the food trade include production of food on the farm, processing and storage on the farm, transport to a food processor, transport to a factory, activities at a factory/processor, transport to retail distribution centre, processing and storage at the retail centre, distribution to the retail store, and then storage at the retail centre. Other flows include the journey made by the consumer to get to the store, return home, store the food, and finally cook it!

16. Legal migrants have a much larger impact than illegal migrants because they have higher incomes and higher resulting emissions, and are more numerous.

17. The number of factories increased from approximately 500 to over 3500 in the late 1990s, but then fell to approximately 2800 in 2005. Employment similarly increased from 100,000 in the early 19080s to around 1.3 million in 2000, before dropping to 1.2m. Exports have risen from less than approximately $5 billion to over $75 billion.

18. The main attractions are low labour costs, relaxed environmental legislation and good access to US markets.

19. The term "agro-industrialization" refers to the large-scale, intensive, high-input, high-output, commercial nature of much modern farming.

20. Farming contributes to global climate change in the emissions of greenhouse gases from livestock (especially methane and nitrous oxides), and also fossil fuels in the use of transport, machinery and in the production of chemical fertilizers.

21. The concept of food miles describes how far food has travelled before it appears on a plate. However, transport cost is only part of the environmental impact of food production – there could be other costs such as use of chemical fertilizers, pesticides, insecticides and herbicides; reduction in biodiversity, eutrophication, decreased water quality and increased risk of flooding.

22. There is conflict over water resources in Kenya between the flower companies and peasant farmers. The biggest companies pay the same as the smallest peasant for water. Moreover, the greatest impact is being felt on the nomadic pastoralists in the semi-arid areas to the north and east of Mt Kenya. The flower farms have taken over land that the pastoralists used and there is now less water.

23. WWF's mission statement is to "stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature", by conserving the world's biological diversity, ensuring that the use of renewable natural resources is sustainable, and promoting the reduction of pollution and wasteful consumption.

24. Critics argue that WWF is too close to large TNCs that destroy the natural environment and that they have abused the rights of indigenous people in the Cameroon rainforest. WWF denies the allegations.

25. Oxfam focuses on economic justice, essential services, rights in crisis and gender justice. Economic justice focuses on improving farming for farmers and labourers, fairer trade, and reducing shocks from energy changes and climate change. Essential services refers to the provision of health education, water and sanitation. Rights in crisis refers to assistance given during conflicts and after disasters, as well as attempts to prevent conflict, improve peacekeeping and allow reconciliation. Gender justice seeks to support women's leadership and increase the number of women receiving an education.

26. Criticisms of Oxfam include allegations that it is politically motivated; that some of its trustees were tax avoiders; and that its stores have forced the closure of small specialist stores and other charity shops.

27. There has been an increase the percentage of national value added in manufacturing in China (up from less than 15% in 1970 to over 35% in 2010) whereas in the other countries there has been a decline in the share of manufacturing, in terms of national value added, between 1970 and 2010. Germany shows a slight increase from around 2008.

28. Two push factors for reshoring include a relative lack of skilled labour in LICs compared with HICs, and rising labour costs in LICs and NICs. Two pull factors include a tradition of manufacturing, and public demand to maintain employment in HICs, and consumers increasingly demanding quick delivery times.

29. Crowdsourcing empowers people and builds mutual support. It is seen as a way of improving a situation using a community's best assets, namely its population. It allows organizations to tap into the creativity of large numbers of people. It offers many opportunities for people to interact with each other and find solutions to old and new problems.

30. Plans and expectations must be clearly stated because there is a danger that different people may interpret plans differently. Moreover, insufficient funding may be raised or there could be project-fatigue.

31. The need for cybersecurity is increasing as more and more people and organizations rely on computers and the internet. In addition, large organizations, government departments, military computer systems and airline carriers are facing increasing threats from hackers. Moreover, there are no international regulations or common rules to abide by, increasing the risk of attacks between countries.

32. The advantages of the e-passport include faster checking in/border clearance. They 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.

Exam practice

Option A Freshwater – drainage basins

(a) (i) Award [1] for each valid point. For example:
The majority were in the northern hemisphere [1]; the USA had most dams [1]; there were a large number of dams in the European Union/Japan/India [1]; there were relatively few dams in most of South America/Africa/Oceania [1].

(ii) Award [1] for each valid point. For example:
By 2005, there are more large dams in all parts of the world [1]; there had been major increases in the number of large dams in China/India [1]; there were a large number of large dams around the coast of South America [1].

(b) Award [1] for each valid point, and a further [1] for development/exemplification. For example:
Large dams store a vast amount of water [1] which can be used for irrigation/hydroelectric production [1].
Large dams may lead to the flooding of areas [1], which causes people to be displaced/flooding of farmland/destruction of cultural buildings [1].
Large dams may lead to the build-up of silt behind the dam in the reservoir [1], and this reduces the amount of nutrients being carried downstream/deposited in the floodplain [1].

(c) Either

Many agricultural activities have an impact on water quality, notably irrigation and the use of fertilizers. The use of irrigation may lead to salinization, and the use of chemical fertilizers/manure may lead to eutrophication and dead zones. However, it is possible to manage irrigation and the use of fertilizers so that the environmental impact is reduced, for example, by reducing the use or the timing of their use.
Good answers are likely to consider two or more ways in which water quality may be affected. They may explain the processes that lead to the impacts, as well as the impacts. They may also consider ways in which the impacts can be managed and so consider the question of "inevitability".
For Band D (5–6 marks) expect some outlining of how agricultural activities may lead to a decline in water quality.
For Band E (7–8 marks) expect a more detailed explanation of how agricultural activities may lead to a decline in water quality, with supporting named and located examples, or a structured discussion of the factors that influence the decline in water quality (for example, place, power, possibilities).
For Band F (9–10 marks) expect both.

Or

Wetlands are defined as "land with soils that are permanently flooded". There are many pressures on wetlands, including conversion of land to agriculture, settlement, transport, aquaculture, recreation etc. Efforts to protect wetlands include the Ramsar Convention, National Parks, conservation areas, river and habitat restoration, and integrated river basin management.
Good answers are likely to describe a range of efforts to protect wetlands. They may provide details of the success, partial success or failure of such measures. They may provide reasons for the degree of success of such schemes (for example, place, possibilities, processes and/or power).
For Band D (5–6 marks) expect some outlining of the efforts to protect wetlands from increasing human pressure.
For Band E (7–8 marks) expect a more detailed explanation of the efforts to protect wetlands from increasing human pressure, with supporting named and located examples, or a structured evaluation of the factors that influence the efforts to protect wetlands (for example, place, power, possibilities).
For Band F (9–10 marks) expect both.

Option B Oceans and coastal margins

(a) (i) Award [1] for each valid point. For example:
They are largely within the tropics [1]; they are mainly on the western side of oceans/eastern side of continents [1]; they are mainly on the edge of continents/islands where the sea is shallow [1].

(ii) Award [1] for each valid point and a further [1] for development/exemplification. For example:
Coral requires high temperature for growth [1], hence coral reefs are mainly found in tropical seas [1].
They are generally located in shallow water/water less than 60 m deep [1] as they need light for photosynthesis [1].

(b) Award [1] for each valid point and a further [1] for development/exemplification. For example:
Coral reefs act as a nursery for young fish [1] and they therefore support fisheries [1]; coral reefs absorb wave energy [1] and so protect against coastal erosion [1].

(c) Either

There are many forms of ocean pollution including radioactive waste, plastics and chemicals. Sources of pollution include marine-based activities such as shipping (transport, tourism, fishing), the fishing industry, offshore mining and extraction, illegal dumping at sea and discarded fishing gear. Land-based activities that contribute to ocean pollution include discharges from storm water drains, industrial effluent, municipal sewage and littering of beaches.
Most forms of pollution relate to human activities, for example, oil spills, although some may be natural, such as volcanic ash and dust. Not all pollution is inevitable – proper management strategies, for example, collection and safe disposal of waste plastic, would reduce the volume of plastic in the oceans, and proper installation of equipment could result in fewer oil spills.
Good answers may consider a number of types of pollution. They may also consider the source of the

pollution, and discuss the "inevitability". They may also look at a range of management options.
For Band D (5–6 marks) expect some outlining of a range of types of oceanic pollution.
For Band E (7–8 marks) expect either a more detailed explanation of a range of types of ocean pollution, with named located examples, or a structured discussion of the factors that influence management of pollution (place, power, possibilities).
For Band F (9–10 marks), expect both.

Or

There are many types of coastal processes. Some are sub-marine, such as wave processes. Some are sub-aerial, such as mass movement, wind erosion and transport, and there are land-based processes, such as those related to rivers, glaciers etc. Some are a combination of sub-marine and sub-aerial, such as longshore drift. Coastal landforms develop as a result of the interaction of processes, lithology (rock types), sea-level changes and human activities.
Some coastal landforms are formed primarily by marine processes, for example, caves, arches, stacks and stumps. Some are formed by the interaction of marine and sub-aerial, for example, cliffs, and some are formed due to the interaction of marine and land-based processes, for example, deltas. In each case, the processes work on the pre-existing rocks or move the material and form new landforms.
Good answers are likely to consider the role of sub-marine and sub-aerial processes. They may consider a range of coastal landforms. They may also attempt to evaluate the relative role of coastal processes in the development of coastal landforms. Another approach may be to consider the role of human activities in managing coastal processes and the development of coastal landforms.
For Band D (5–6 marks) expect some outlining of two or more coastal processes in the development of coastal landforms.
For Band E (7–8 marks) expect either a more detailed explanation of two or more coastal processes in the development of coastal landforms, with named located examples, or a structured evaluation of the factors that influence coastal processes and landforms (processes, place, power, possibilities).
For Band F (9–10 marks), expect both.

Option C Extreme environments

(a) (i) A – corrie lake (tarn) [1]; B – ribbon lake [1].

(ii) Award [1] for each valid explanation. For example:
Freeze-thaw weathering leads to a deepening and the headward recession of the hollow/corrie [1].
Rotational movement of the glacier leads to a deepening of the corrie, and the development of a corrie lip [1].
The collection of water in the hollow, following the melting of the corrie, produces the lake [1].

(b) Award [1] for each valid point and a further [1] for the development/exemplification. For example:
There is a possibility for water sports/fishing in the upper lake/ribbon lake [1].
There are opportunities for walking/hiking in steep upland areas [1]; there are opportunities for rock climbing near Lough Nahanagan on the steep cliffs/crags [1]; there may be possibilities for bird-watching [1] around the cliffs, crags and lake at Lough Nahanagan.

(c) Either

Desertification is the spread of desert-like conditions into areas that were previously productive. There are many causes of desertification – over-cultivation, overgrazing and deforestation – but it can also be natural, for example, due to long-term climate change. Desertification is more likely to occur in areas that are relatively dry/seasonally dry and in places that have a rapidly growing population. As the global climate changes, some areas that were previously productive may become desertified. Management of desertification requires a reversal of the causes of desertification, that is, overgrazing and over-cultivation (improved stock quality, reduced herd size, greater use of fertilizers, irrigation and revegetation).
Good answers are likely to consider a range of causes of desertification. They may discuss the factors that lead to desertification, for example, population growth, rural poverty and declining soil fertility, and discuss the potential solutions to desertification. They may compare different places and discuss reasons for variations in the scale and severity of desertification, and its possible management.
For Band D (5–6 marks) expect some outlining of the causes and/or consequences of desertification.
For Band E (7–8 marks) expect either a more detailed explanation of the causes and/or consequences of desertification, with named located examples, or a structured discussion of the question of "inevitabilty" and different management options.
For Band F (9–10 marks), expect both.

Or

New technologies in extreme environments include desalination and solar power in hot, arid areas. An example of sustainable development in a hot, arid area is sustainable farming at Bustan in Egypt. Bustan is a labour-intensive farm and uses hydroponics, recycling of water and sustainable pest control methods, for example. At present, many of these technologies are used on a small scale and have not yet transformed the large-scale economies of extreme environments.
Good answers may examine a range of new technologies that are used in extreme environments. They may also examine the potential for sustainable development, and the characteristics of sustainable

development schemes. They may also examine the potential benefits of large-scale sustainable development such as desalination of seawater and solar energy.
For Band D (5–6 marks) expect some outlining of two or more forms of new technology/sustainable development available in extreme environments.
For Band E (7–8 marks) expect either a more detailed explanation of two or more forms of new technology/sustainable development available in extreme environments, with named located examples, or a structured discussion regarding the concepts of place, power and possibilities in relation to the potential for new technologies/sustainable development in extreme environments.
For Band F (9–10 marks), expect both.

Option D Geophysical hazards

(a) **(i)** Award [1] for each valid point, up to a maximum of [2]. For example:
Landslides may be modified by altering the slope angle (regrading/terracing) [1]/drainage of water from within the landmass [1]/people could be removed from the base of the slope [1].

(ii) Award [1] for a valid point and a further [1] for the development/extension. For example:
Quality of life decreases due the destruction of buildings/infrastructure [1], which may lead to people having to live in tents/the spread of diseases such as cholera [1].

(b) Award [1] for each valid point, and a further [2] for each process. For example:
Relief/rehabilitation: at first the focus is on rescuing people and reducing the number of fatalities [1]; next there is the provision of emergency services such as water, accommodation, medication and food [1]; some of this help may be from international sources [1].
Reconstruction: this may take many years [1]; the main aim is to restore conditions to at least as good, if not better, than before the hazard event [1]; housing and infrastructure is rebuilt [1]; in some cases new settlements may be built, for example, Little Bay on the island of Montserrat, following the abandonment of the former capital city, Plymouth [1].

(c) **Either**

Social factors include gender, race, age of population, education and public awareness. For example, people with a better education generally have a higher income and can afford better-quality housing. Many women are carers for their children and/or parents and may feel responsible for them following a hazard event.
Good answers are likely to consider a range of social factors and look at the impact that these have on geophysical risk. They may also consider how geophysical risk may be socially selective, for example, poor/immigrants and/or slum dwellers are more at risk.
For Band D (5–6 marks) expect some outlining of social factors that affect geophysical risk.
For Band E (7–8 marks) expect either a more detailed explanation of social factors that affect geophysical risk, with named located examples, or a structured examination of how risk varies with place, power and possibilities.
For Band F (9–10 marks), expect both.

Or

Hazard magnitude and frequency refers to the probability of an event of a given size occurring. The cost of protecting against very high magnitude, low frequency events is extremely expensive and may be considered inappropriate. Many societies protect against hazard events that might be expected within a human lifetime rather than protecting against more extreme events, for example, with a recurrence of over 100 years. Moreover, it is not only difficult to predict the size and timing of the event, but the location of the hazard may be difficult to predict.
Good answers may consider the relationship between hazard magnitude and frequency. They may also examine the potential impact on different places, for example, high-income countries, low-income countries and densely populated cities. They may consider different strategies (mitigation/adaptation) in contrasting areas.
For Band D (5–6 marks) expect some outlining of the relationship between hazard magnitude and frequency.
For Band E (7–8 marks) expect either a more detailed explanation of the relationship between hazard magnitude and frequency, with named located examples, or a critical examination of the factors that influence the development of management strategies (place, power, possibilities and processes).
For Band F (9–10 marks), expect both.

Option E Leisure, tourism and sport

(a) **(i)** Award [1] for two tourist activities and a further [1] for some development/extension. For example:
Tourist activities on the Great Barrier Reef include boating, diving, fishing, photography, collecting (not coral) [1]; they are all associated with the natural environment [1].

(ii) The Great Barrier Reef has a very long/large extent of coral reef [1]; it has a management strategy that enables different activities to take place [1].

(b) Award [1] for a correct point and a further [1] for development/extension, up to a maximum of [6]. For example:
Tourism creates jobs in the area [1] and there are multiplier effects of tourists visiting the area [1].
Most tourists travel by car or plane, and these emit greenhouse gases [1] which contribute to global climate change [1].

There may be overfishing [1] which reduces the sustainability of the fish stock/disrupts the marine ecosystem [1].

(c) Either

There are many ways in which TNCs are involved in the touristic industry – airlines, hotels, cruise lines, tour operators and travel agents. There are many advantages of this, for example, their presence can increase tourist demand; TNCs are able to provide high standards of accommodation; TNCs can introduce a diverse range of new technologies and skills into an economy including advanced management, environmental and financial systems; and TNCs can provide a greater range of tourist activities in some destinations, which can lead to innovation by local firms. However, much of the employment they create is part-time, seasonal, unskilled and low paid; there is an outflow of wealth (leakage) – much of the income generated by tourism (transport, accommodation, restaurants and bars) leaves the host country and passes to the countries that the TNCs are based in; and much of the decisions about where to invest, what type of facility, are made on the basis of how it will benefit the TNC and its shareholders rather than local communities.

Good answers are likely to examine the ways in which TNCs are involved in the tourist industry. They may consider the advantages and disadvantages of TNC involvement. They may also consider variations in the impact of TNCs due to variations in place, power and possibilities.

At Band D (5–6 marks) expect some outlining of TNCs in the provision of tourist infrastructure and facilities.

For Band E (7–8 marks) expect either a more detailed explanation of TNCs in the provision of tourist infrastructure and facilities, with named located examples, or a critical evaluation of the factors that influence the impacts of TNCs (place, power, possibilities and processes).

For Band F (9–10 marks), expect both.

Or

Sustainable tourism involves local people in development processes; recognizes and values the aesthetic appeal of environments; respects local cultures, livelihoods and customs; promotes equity in the distribution of the costs and benefits of tourism; maintains biological diversity (biodiversity); and ensures that renewable sources are not consumed at a rate that is faster than the rate of natural replacement. Ecotourism is considered to be a form of sustainable tourism. It involves a relatively low number of tourists. It aims to reduce the environmental impact of tourism, although cannot reduce it completely. Locally produced goods, local employment and the preservation of local culture are also part of sustainable tourism. However, most tourists are responsible for the release of greenhouse gases via their mode of transport, consumption of resources, provision of hot water etc.

Good answers may consider the characteristics of sustainable tourist developments. They may examine the ways in which sustainable tourist developments may partially achieve sustainability. They may also consider reasons why sustainable tourist developments can never be fully sustainable, and that some forms of tourism are more sustainable than others.

At Band D (5–6 marks) expect some outlining of sustainable tourism developments.

For Band E (7–8 marks) expect either a more detailed explanation of sustainable tourism developments, with named located examples, or a critical structured examination of the benefits (desirability) and limitations (impossibility) of sustainable tourist developments.

For Band F (9–10 marks), expect both.

Option F The geography of food and health

(a) (i) Award [1] for each valid description, up to a maximum of [3]. For example:
Initially, the Ebola virus is concentrated around Gueckedou in southern Guinea, near the border with Sierra Leone and Liberia [1]. By September 2014, it has spread outwards, mainly in Liberia and eastern Sierra Leone, and has reached the coast of Liberia [1]. By March 2015, most parts of the three countries have been affected, apart from the north-western part of Guinea [1].

(ii) Award [1] for each valid reason, up to a maximum of [4]. For example:
Diseases can be spread in many ways. Some diseases are vector-borne and spread by high densities of particular insects, for example, mosquitoes [1]; high population densities allow for the rapid spread of disease [1]; population mobility allows for the transfer of diseases [1]; a lack of barriers such as border control/screening, and physical barriers may enable the transmission of disease [1].

(b) Award [1] for each valid comparison and a further [1] for development/exemplification, up to a maximum of [4]. For example:
Preventative health care is low cost and uses limited technology to prevent diseases from happening [1]. For example, primary health care promotes growth monitoring [1] which enables health personnel and mothers to recognize when a child is failing to grow, so action can be taken [1]. Curative health care treats the disease [1] and tends to be expensive but is able to treat some complex health problems, for example, heart disease/brain surgery [1].

(c) Either

There are many factors that affect the severity of famine. Physical factors include drought, insect infestations, fire and other natural hazards. Human factors include population growth, unemployment/ entitlement to food, civil unrest, governance and access

to land. In most cases, it is the interaction of physical and human factors that increases the risk of famine. Good answers are likely to discuss the role of physical and human factors in the development of famine. They may also consider how such factors vary from place to place, and over time. They may also consider how famines differ in terms of their severity (processes, power).
At Band D (5–6 marks) expect some outlining of the physical factors that lead to famine.
For Band E (7–8 marks) expect either a more detailed explanation of the physical and human factors that lead to famine, with named located examples, or a critical discussion of the relative importance of factors that affect the severity of famines (place, power, processes).
For Band F (9–10 marks), expect both.

Or

Food security for a population exists when all its people always have access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. Food security for a household means access by all its members at all times to enough food for an active, healthy life. In HICs, such as the UK, up to one-third of food is wasted each year. In some LICs, it can be as high as 80%. More efficient farming practices and better transport, storage and processing facilities ensure that a larger proportion of the food produced reaches markets and consumers. Reducing food waste would contribute a great deal to achieving food security. Other ways of achieving food security include increasing food production, food aid, greater use of improved seeds and fertilizers, investment in agriculture, greater use of GM crops and more free trade.
Good answers are likely to consider a number of ways of achieving food security. They may examine short-term and long-term measures, and national and international policies to reduce waste. They may compare different ways of achieving food security, and reach a conclusion as to the most effective way of achieving food security.
At Band D (5–6 marks) expect some outlining of ways of achieving food security, including reducing food waste.
For Band E (7–8 marks) expect either a more detailed explanation of ways of achieving food security, including reducing food waste, with named located examples, or a critical discussion of the relative importance of factors that affect food security (place, power, processes, possibilities).
For Band F (9–10 marks), expect both.

Option G Urban environments

(a) (i) A decline/deterioration in air quality that is harmful to human health [1].

(ii) Award [1] for each valid point, up to a maximum of [3]. For example:
The amount of NO in the atmosphere is generally at a low level (<20 ppb) in the morning, but rises from around 6 am to peak at about 70 ppb by 9 am [1].
It then declines to around 20 ppb by 6 pm [1] and rises to around 50 ppb between 8 pm and 9 pm [1].
It then declines to around 20 ppb by 4 am [1]. NO_2 shows a similar trend – morning peak around 11 am and an evening peak around 9 pm, but at lower levels (40 ppb in the morning, 30 ppb in the evening) [1].

(iii) Award [1] for each valid point, up to a maximum of [2]. For example:
Vehicles are a major source of NOx, CO and particulates [1]; some residential areas/coal-fired power stations may emit SO_2 [1].

(iv) Award [1] for each valid point and a further [1] for development/exemplification, up to a maximum of [4].
For example:
Park and ride schemes lead to a reduction of the amount of traffic on the road [1] and this reduces overall emissions of particulates and pollutants [1]; the creation of open spaces/planting trees may improve air quality [1] as vegetation may filter some pollutants, reducing the risk of smog [1].

(b) Either

Deprivation takes many forms – including low incomes, a lack of employment opportunities, ill health, poor educational achievement, limited access to housing and services, high rates of crime and a poor living environment. There are many potential solutions to urban deprivation including job creation, the provision of new housing, improved educational and health facilities, and improvements to the general environment. The causes of deprivation vary, and so too does the nature of deprivation. Deprivation varies between countries, and within cities. The scale of deprivation also varies.
Good answers are likely to examine the varied nature of urban deprivation. They may contrast the nature of deprivation in different urban areas in countries of varying degrees of wealth. They may also consider different types of solution, and comment on their relative success or failure.
At Band D (5–6 marks) expect some outlining of the nature of urban deprivation.
For Band E (7–8 marks) expect either a more detailed explanation of the nature of urban deprivation, with named located examples, or a critical examination of the potential solutions to urban deprivation (place, power, processes, possibilities).
For Band F (9–10 marks), expect both.

Or

The sustainable management of urban areas can have economic, social or environmental aspects, and ideally all three. Sustainable management of cities may produce circular urban systems whereas unsustainable development leads to linear systems. There are a number of sustainable urban strategies, for example, recycling, re-use, reduce, sustainable forms of transport, urban agriculture, sustainable forms of

energy etc. Some of these may be small-scale, for example, BedZED in south-west London, whereas others are much larger in scale, for example, Curitiba, Brazil or Masdar City, UAE.
Good answers are likely to present the achievements and limitations of sustainable management. They may discuss external/long-term issues affecting the sustainable management of urban areas, for example, the context of continuing population growth/rural–urban movement. Another approach might be to compare cities in countries at different stages of development. An alternative might be to discuss how some strands of sustainability (social/housing) could be easier to achieve than others (ecological footprint minimization).
At Band D (5–6 marks) expect some outlining of a limited range of sustainable strategies.
For Band E (7–8 marks) expect either a more detailed explanation of sustainable strategies, with named located examples, or a critical discussion of factors that influence the relative success or failure of sustainable strategies (place, power, processes, possibilities).
For Band F (9–10 marks), expect both.

Unit 1 Changing population

(a) (i) The average number of years that a person can be expected to live [1], usually from birth [1].

(ii) Award [1] for each valid point, up to a maximum of [4]. For example:
Life expectancy increased for the top four quintiles of men [1] but only the top quintile of women between 1980 and 2010 [1]. Life expectancy decreased for the lowest quintile of men, but for the lowest four quintiles of women [1]. Women's life expectancy is higher for the top quintile and lowest two quintiles, than for the corresponding quintiles for men [1].

(iii) Award [1] for each valid point, up to a maximum of [4]. For example:
Reasons for the differences in life expectancy could be due to more men working in jobs that demand hard, physical labour, especially among the lower quintiles [1], as well as a more "self-destructive" lifestyle (smoking, drinking, lack of exercise) [1].
Reasons for the increased life expectancy among the wealthy could be due to less physically demanding jobs [1] and greater awareness of a healthy lifestyle [1], whereas decreased life expectancy may be due to rising poverty/impact of increased mortality from diseases such as AIDS/diabetes/heart disease [1].

(b) (i) Award [1] for each valid point, up to a maximum of [3]. For example:
The global occurrence of trafficking is very high in parts of North Africa and the Middle East, central and East Africa and in parts of South Asia. [1] There are medium rates of trafficking in the northern part of South America, Southern Africa and Eastern Europe. [1]The lowest rates of trafficking are in North America, Western Europe, Brazil and Australia. [1]

(ii) Award [1] for each valid point, up to a maximum of [3]. For example:
Trafficking takes many forms. The victims may be forced to do a range of jobs, including farming, domestic service, prostitution and working in factories [1]. They are 'employed' in a variety of locations, e.g. rural, suburban and urban [1].
Trafficking is very widespread [1].

(iii) Award [1] for each valid point and a further [1] for development/exemplification, up to a maximum of [4].
For example:
People are forced to act against their will [1].
They may be threatened with violence, threats, manipulation and force [1]. They may have their papers/passports taken from them [1] so they are unable to move around freely [1].

(c) Either

For many people, megacities offer the prospects of a job, a home and an opportunity to improve their standard of living and quality of life. For some, migration to megacities does improve their standard of living, but for others migration may result in unemployment or underemployment, poor-quality housing and the risk of many environmental hazards. For societies, having large numbers of people living close together may make it easier to provide housing and health care, for example, but if there are too many people, the provision of such services is inadequate. Megacity growth is associated with expansion of the built area, increased traffic congestion, air pollution and declining water quality.
Good answers may consider the opportunities and challenges that megacities provide for individuals and societies. They may also examine variations due to power and place (for example, high income and low-income countries), processes (for example, the rate of migration and natural increase), possibilities (management strategies to manage the city).
At Band D (5–6 marks) expect some outlining of the challenges and opportunities of megacities for individuals and societies.
For Band E (7–8 marks) expect either a more detailed explanation of the challenges and opportunities of megacities for individuals and societies, with named located examples, or a critical examination of factors that create opportunities/challenges in megacities (place, power, processes, possibilities).
For Band F (9–10 marks), expect both.

Or

Forced migration is a general term that refers to "the movement of refugees and internally displaced people (those displaced by conflicts) as well as people displaced by natural or environmental disasters, chemical or nuclear

disasters, famine or development projects". There are different types of forced migrants, including refugees, asylum seekers and internally displaced people.
Natural disasters resulting in large numbers of displaced people include volcanoes, hurricanes, landslides, and environmental change (global warming, desertification, land degradation). Development-induced displacement includes people forced to move as a result of large-scale infrastructure projects such as dams, motorways, airports, urban redevelopment, mining, deforestation, and even the creation of conservation schemes.
Conflict-induced displacement includes people who are forced to move due to armed conflict such as civil war, violence or persecution on the basis of their nationality, race, religion, political opinion or social group. In 2015 there were some 15 million refugees and approximately 40 million internally displaced people (IDPs).
Good answers are likely to consider environmental causes of forced migration as well as political causes. They may also discuss the scale of the migration (for example, number of people involved/how far they have travelled), and the outcome (whether they were allowed to stay/turned back). They may also consider trends and patterns in forced migration, for example, the main sources of forced migration (power and place) and temporal changes, for example, due to climate change (processes).
At Band D (5–6 marks) expect some outlining of the environmental and/or political causes of forced migration.
For Band E (7–8 marks) expect either a more detailed explanation of the environmental and political causes of forced migration, with named located examples, or a critical discussion of the factors that influence the relative importance of environmental and political causes (place, power, processes).
For Band F (9–10 marks), expect both.

Unit 2 Global climate – vulnerability and resilience

(a) (i) Extensive damage to coral reefs will occur with an increase of global temperatures of 2°C [1].

(ii) An increase of up to 3°C may lead to increasing yields in some high-latitude regions [1].

(iii) Dangerous feedback and abrupt large-scale shifts in climate appear after an increase of about 1.75°C [1].

(iv) Award one mark for the identification of each problem and a further [1] for the development/exemplification, up to a maximum of [4]. For example:
Increased melting of glaciers [1] can lead to increased run-off to the oceans and a decrease in long-term water availability [1]; increased frequency and/or magnitude of flooding [1] due to increased atmospheric energy [1]; increased sea level rise [1] leading to coastal flooding/saline intrusion into groundwater reserves [1].

(v) Award [1] for each valid suggestion, up to a maximum of [3]. For example:
Extreme temperatures may be outside the tolerance/range of many crops [1]; water shortages may be caused by increased temperatures/evaporation [1]; increased risk of natural disasters, especially fire [1]; increased range of pests, especially locusts [1].

(b) (i) Award [1] for each valid point, up to a maximum of [3]. For example:
Puget Sound has risen by 20 cm [1]; the temperature of 80% of rivers now exceeds the safe temperature for salmon [1]; the average snow pack has decreased 25% since the 1950s [1], and forest fires are more common since the 1970s [1].

(ii) Award [1] for each valid point, up to a maximum of [3]. For example:
Fish yields have decreased, which is affecting the viability of fishing, whether commercial or recreational (revenue from licences) [1]; forest fires have destroyed trees, which reduces forestry income [1]; the ocean is more acidic, which will affect lobsters and other shell fish (decreased yields) [1]; the decreased snow pack may reduce the number of tourists/local skiers and the incomes they provide [1].

(iii) Award [1] for each valid point, up to a maximum of [4]. For example:
Increased acidification could lead to poor water quality/links with mental disease [1]; wildfires lead to more particulates in the atmosphere and reduced air quality/impacts on health [1]; floods in winter may reduce the quality of drinking water (more suspended sediment in the water) [1]; the decline in forest cover may reduce the quality of the ecosystem services that it produces such as climate regulation, air quality and water quality/regulation, and the potential impacts that these have on human health [1].

(c) Either

All people are vulnerable to the impacts of climate change – some directly and others indirectly. However, some population groups are more vulnerable to climate change than others. These include the very young, the elderly, those with disabilities, the poor, minority groups, refugees and indigenous people. Carers, who are generally women, are also vulnerable, because of their burden of caring for the young, the elderly and the sick. Single-parent households are often very vulnerable to climate change as they may combine a number of at-risk characteristics, such as age, gender and poverty.
It is not just people who are affected by climate change. Institutions such as the emergency services, schools, transport services, physical infrastructure, political organizations and economic activities may all be at risk.
In addition, some locations are more at risk than others. These include low-lying islands, river mouths and valleys,

coastal areas and regions that derive their water supplies from mountain glaciers.
Good answers are likely to describe the risks associated with global climate change and they are likely to examine how certain population groups are more vulnerable to climate change than others as well as examining why certain locations are more at risk from global climate change than others as well as examining why certain population groups choose/are forced to live in areas that are at increased risk of global climate change.
At Band D (5–6 marks) expect some outlining of the likely impacts of global climate change on people.
For Band E (7–8 marks) expect **either** a more detailed explanation of the likely impacts of global climate change on different people, with support, **or** a structured examination of the factors that affect the impact of global climate change on different people.
For Band F (9–10 marks), expect both.

Or

Feedback mechanisms play a key role in controlling the Earth's atmosphere, and any changes to these mechanisms are likely to have implications for the climate. Both positive and negative feedback mechanisms are associated with changes in mean global temperature. Feedback mechanisms associated with global warming tend to involve very long time lags. By the time effects appear, the mechanisms responsible may have already gone past the tipping point (the point of no return).
Positive feedback mechanisms can be observed in polar and periglacial areas. Rotting vegetation trapped under permafrost in the tundra releases methane that is unable to escape because of the ice covering. Increased thawing of permafrost will lead to an increase in methane levels as the gas escapes, adding to global warming gases in the atmosphere thereby increasing mean global temperature.
Other mechanisms of positive feedback include: increased carbon dioxide released from increased biomass decomposition due to rising temperatures, especially in forest regions, leading to a further rise in temperature as greenhouse gases are added to the atmosphere; and, increased forest cover in high latitudes, decreasing albedo and increasing warming.
Negative feedbacks include increased evaporation in tropical and temperate latitudes leading to increased snowfalls in polar areas. Other mechanisms of negative feedback include: burning, causing more solid particulates in the atmosphere, leading to more reflection of solar radiation and thus reduced solar radiation at the surface, thereby causing cooling; and increased evaporation leading to increased cooling.
Good answers are likely to discuss positive and negative feedbacks and they are likely to consider how positive feedback may be linked to tipping points whereas negative feedbacks produce a steady state. Good answers are likely to examine the time-scales involved, and are likely to consider the role of feedback in the enhanced greenhouse effect (global warming).
At Band D (5–6 marks) expect some outlining of feedback loops and the global energy balance.
For Band E (7–8 marks) expect **either** a more detailed explanation of feedback loops and the global energy balance, with support, **or** a structured discussion of feedback loops (positive/negative) and the global energy balance (long term and short term).
For Band F (9–10 marks), expect both.

Unit 3 Global resource consumption and security

(a) (i) Award [1] for each valid point and a further [1] for its development, up to a maximum of [2]. For example:
Water can influence energy production through the construction of dams, for example, the Three Gorges dam [1]. This enables production of hydroelectric power, and may provide a significant source of energy [1]. A high head of water is required to drive to turbines.

(ii) Award [1] for each valid point and a further [1] for its development, up to a maximum of [2]. For example:
Energy is used in the provision of mechanization, for example, tractors/combine harvesters [1]; these allow much more land to be cultivated than by using human labour or animal labour, and so increase productivity [1].

(iii) Award [1] for each valid point and a further [1] for its development, up to a maximum of [2]. For example:
Agriculture/food production is the major use of water around the world, accounting for 70% of global water use [1]; in cases where water use is intense, water tables may drop, and there can be water shortages for consumers/energy providers and industry [1].

(iv) Award [1] mark for each valid point and a further [1] mark for further development/exemplification.
For example: the water-energy-food nexus stresses the inter-relationships between the three sectors [1]. Any change in one of the factors is likely to have an impact on one or both of the other two [1].
For example, an increase in the use of water for irrigation may reduce the amount of water available for HEP [1] or an increase in the use of mechanisation/machines in agriculture may reduce the amount of energy available for desalination or pumping of groundwater [1].

(b) (i) Award [1] for each valid point, up to a maximum of [2]. For example:
Refurbish means to restore and to make useful again [1]; recycle refers the manufacture of a used good into another good that can be used again e.g. bottles, paper, aluminium [1]. However, not all products can be recycled. Coffee cups made from cardboard with plastic coating cannot be recycled.

(ii) Award [1] for each valid point, up to a maximum of [2]. For example:

Natural capital can be allowed to decompose [1] and can be used as fertiliser on fields. When the fertilizer is taken up by living things that eventually die and are converted to fertilizer, the cycle repeats, and so the fertilizer is used many times over [1].

(iii) Award [1] for each valid point, up to a maximum of [2]. For example:
Repair, re-use and refurbish/re-manufacture produces new versions of the same good – they reduce the initial use of raw materials [1]. It is a cheaper option than manufacturing goods from new. Recycling is expensive and requires significant energy input (the others, i.e. repair, re-use and re-manufacture, reduce the amount of energy needed for production) [1].

(iv) Award [1] for each valid point and a further [1] for the development/exemplification of the point, up to a maximum of [4]. For example:
Advantages of the circular economy include reduction of waste [1]; greater resource productivity [1]; it addresses emerging resource security/scarcity issues in the future [1]; and it helps to reduce the environmental impacts of production and consumption. [1]

(c) Either

An ecological footprint is the hypothetical area of land required by a society, a group or an individual to fulfil all their resource needs and assimilate all their wastes. It is measured in global hectares (gha). Ecological footprints can act as a model for monitoring environmental impact. They can also allow for direct comparisons between groups and individuals, such as comparing LICs and HICs. They can highlight sustainable and unsustainable lifestyles, for example, populations with a larger footprint than their land area are living beyond sustainable limits. HICs' resource use is often wasteful and HICs produce far more waste and pollution as by-products of production. People in LICs, by contrast, have less to spend on consumption and the informal economy in LICs is responsible for recycling many resources. However, as LICs develop, their ecological footprint size increases. However, precise ecological footprints are very difficult to measure, and not all resources consumed are measured.
Good answers are likely to define ecological footprints, and show how they can help to measure resource consumption. They are likely to compare HICs with LICs, and to shows changes in composition/size over time. They may also consider alternative measures such as carbon footprints, food miles and/or environmental sustainability index.
At Band D (5–6 marks) expect some outlining of ecological footprints.
For Band E (7–8 marks) expect **either** a more detailed explanation of ecological footprints, with support, **or** a structured examination of ecological footprints as a measure of resource consumption.
For Band F (9–10 marks), expect both.

Or

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 at all times. A circular economy aims to rebuild capital, whether it is financial, manufactured, natural, social or human. In a completely circular economy, consumption only occurs in bio-cycles, in which resources can be recovered and restored. In the circular economy, waste is minimized by the use of biological materials, which can be composted. Artificial (technical) materials, such as alloys and polymers, are designed for repeated use. Systems are designed to run on renewable energy.
Good answers are likely to describe the circular economy, using examples, for example, the remanufacture and reconditioning of vehicles, mobile phones and/or washing machines. They are likely to discuss the meaning of the term "resource stewardship". They may also discuss the relative strengths of re-use, reduce, refurbish/re-manufacture and recycling. They may compare the advantages of the circular economy with that of the linear economy.
At Band D (5–6 marks) expect some outlining of the circular economy.
For Band E (7–8 marks) expect **either** a more detailed explanation of the circular economy, with support, **or** a structured discussion of the value of the circular economy as a strategy for resource stewardship.
For Band F (9–10 marks), expect both.

Unit 4 Power, places and networks

(a) The KOF Index of Globalization, introduced in 2002, defines globalization as "the process of creating networks of connections among actors at multi-continental distances, mediated through a variety of flows including people, information and ideas, capital and goods". The KOF Index covers the economic, social and political dimensions of globalization:

- The economic dimension – long-distance flows of goods, capital and services, as well as information and perceptions that accompany market exchanges (36 per cent of the Index).
- The social dimension – the spread of ideas, information, images and people (38 per cent of the Index).
- The political dimension – the diffusion of government policies (26 per cent of the Index).

Other globalization indices include the EY Globalization Index was developed by the Economist Intelligence Unit to measure the 60 largest countries/territories by GDP according to their level of globalization. The Index looks at each country's openness to trade, capital flows, exchange of technology and ideas, labour movements and cultural

integration. The New Globalization Index tends to show similar results. It is based on finance, trade and politics, and social factors.

Good answers are likely to describe at least two globalisation indices. They are likely to consider the composition of globalisation indices. They may also consider whether the components used are the best/only way of measuring globalisation. They are likely to suggest which of the measures is the best, and give reasons for their view.

For Band C (4–6 marks), expect some outlining of two indices of globalisation.

For Band D (7–9 marks), expect either a more detailed explanation of two or more indices of globalisation, including supporting evidence, or a structured examination of the components that produce the index of globalisation (social, economic, political).

For Band E (10–12 marks), expect both.

(b) Improvements in technology include the growth of global data flow, transport developments, and the growth of communications networks. The world has become more interconnected than ever before. Digitization has changed globalization in many ways. It is driving down the cost of cross-border communications and transactions, allowing businesses to connect with other businesses and customers in almost any part of the world. HICs are the most globally connected countries, although NICs and LICs are closing the gap slowly.

The frictional effect of distance, or distance decay, suggests that areas that are close together are usually more likely to interact with one another, whereas areas far apart are less likely to interact with one another. There has been a reduction in the frictional effect of distance, as improvements in transport have allowed people to travel greater distances in less time. Containers are the backbone of the modern global economy.

Good answers are likely to describe **two or more** technological innovations. They are likely to explain how technological innovations can make the world smaller. They may also suggest that not all places benefit from technological innovations, and therefore have not benefitted from a shrinking world. They are likely to refer to the growth of national/protectionism/political borders in reducing the flow of labour/capital and goods, and so therefore reduce the impact of technological innovations.

For Band C (5–8 marks), expect some outlining of two or more technological innovations.

For Band D (9–12 marks), expect either a more detailed explanation of two or more technological innovations, with supporting evidence, or a balanced discussion of the factors that enable/limit the ability of technological innovations to produce a shrinking world.

For Band E (13–16 marks), expect both.

Unit 5 Human development and diversity

(a) There are many development indicators and indices, including the HDI, GII and others such as the human poverty index and gender empowerment measure. Composite indicators use a variety of measurements which give them greater reliability. In contrast, single indicators are liable to over-emphasize the indicator in question.

Good answers are likely to examine at least two development indicators; they may compare composite indicators with single-measure indices; they may compare the results of different composite indicators such as the HDI and the GII; they may discuss the advantages and disadvantages of each; they may discuss the validity and/or reliability of development indicators and indices.

For Band C (4–6 marks) expect some outlining of two or more developments indicators and/or indices.

For Band D (7–9 marks) expect either a more detailed explanation of two or more development indicators, with supporting examples, or a structured discussion of the validity and reliability of development indicators and indices.

For Band E (10–12 marks) expect both.

(b) There are many reasons for the rise of anti-immigration groups. The main concerns of those opposed to immigration are the perceived threats over competition for jobs, and the cost of housing, education and health care. In some cases, notably in LICs and NICs, environmental issues may also be a concern, due to rapid population growth. Some argue that certain immigrant groups isolate themselves from society and refuse to integrate into mainstream society. If migrants are unable to assimilate into society, they may form ghettos. Other concerns include increased crime rates and the spread of infectious diseases. The 2008 economic crisis, the euro crisis and the increase in the number of migrants from Syria, the Middle East and North Africa have combined to make many Europeans anxious about migration. This has led to an increase in right-wing political parties opposed to immigration in many European nations, including Austria, Hungary, Germany, France and the UK.

The result of anti-immigration movements have been a tightening of migrant numbers, the relocation/repatriation of migrants, the exclusion of some groups such as the Rohingyas, and the seizing of migrants assets from asylum seekers while processing their needs.

Good answers are likely to examine a range of reasons for the rise of anti-immigration groups; they may illustrate this with reference to located examples; they are likely to identify one or more anti-immigration movements such as the Danish People's Party and the UK's UKIP; they may consider a range of results such as reduced numbers of migrants, tougher controls, a rise in anti-race crime, increased nationalism and isolationalism.

For Band C (5–8 marks) expect some outlining of the reasons and/or results of the growth of anti-immigration groups.
For Band D (9–12 marks) expect either a more detailed explanation of two or more reasons and/or results of the growth of anti-immigration movements, with support (expect at least one anti-immigration movement to be named) or a structured examination of the factors affecting the growth and impacts of anti-immigration movements.
For Band E (13–16 marks) expect both.

Unit 6 Global risks and resilience

(a) In some countries, the reaction against increased globalization has been a rise in nationalism. This new nationalism takes many forms: protectionist policies such as trade barriers, policies favouring domestic workers, anti-immigration measures and resource nationalism. In some locations, access to social media has been restricted. In the most extreme cases, economic failure and a lack of opportunities for young people are fuelling extremism, resentment of globalization and the West, and, in extreme cases, terrorism. The election of President Trump, the UK's vote for Brexit, and the growth of right-wing political parties in the EU are examples of renewed nationalism. However, other countries, notably small ones, are still in favour of globalisation, e.g. Singapore.
Good responses are likely to examine a number of links between globalisation and the rise of nationalism. They may examine the rise of nationalism in different places, and how it varies from place to place and over time. Another approach may be to examine countries that have remained committed to globalisation and have not experienced a rise in nationalism.
For Band C (4–6 marks) expect some outlining of the relationship between increased globalization and the rise of nationalism.
For Band D (7–9 marks) expect either a more detailed explanation of the relationship between increased globalization and the rise of nationalism, with supporting examples, or a structured examination of the factors that influence the rise of nationalism (or not).
For Band E (10–12 marks) expect both.

(b) There are many types of global flows including trans-boundary pollution, shipping, carbon footprints, population flows, global shift of industry and food production. Many of these are associated with environmental risks e.g. the impacts of acidification, pollution related to shipping, food miles, environmental degradation related to large-scale commercial farming and the relocation of polluting industries. However, there are some global flows and shifts that may not cause as much environmental risk e.g. fair trade/ethical trade, and the trade in goods designed to reduce environmental degradation e.g. solar panels and wind turbines.
Good responses are likely to discuss the environmental impact of a range of global flows and global shift. They may compare the impacts of different flows and on different places. Some responses may question whether the impacts are 'inevitable' and whether there is a scale of impacts e.g. some are very severe, but others are less severe.
For Band C (5–8 marks) expect some outlining of the environmental risks associated with global flows and global shifts.
For Band D (9–12 marks) expect either a more detailed explanation of the environmental risks associated with global flows and global shifts, with support, or a structured discussion of the factors affecting the scale of the impacts on different places.
For Band E (13–16 marks) expect both.

THE RELATIVE IMPORTANCE OF ESSAYS AT HL AND SL

IB exams consist of a number of different approaches to assessment, including extended responses. The advice given here is directed towards conventional extended answers (essays), which are compulsory in all papers. In both cases, one essay carries a relatively heavy mark weighting, as shown below:

- Paper 1 HL and SL 17.5% of total marks
- Paper 2 HL 5% and SL 8% of total marks
- Paper 3 (HL only) 20% of total marks

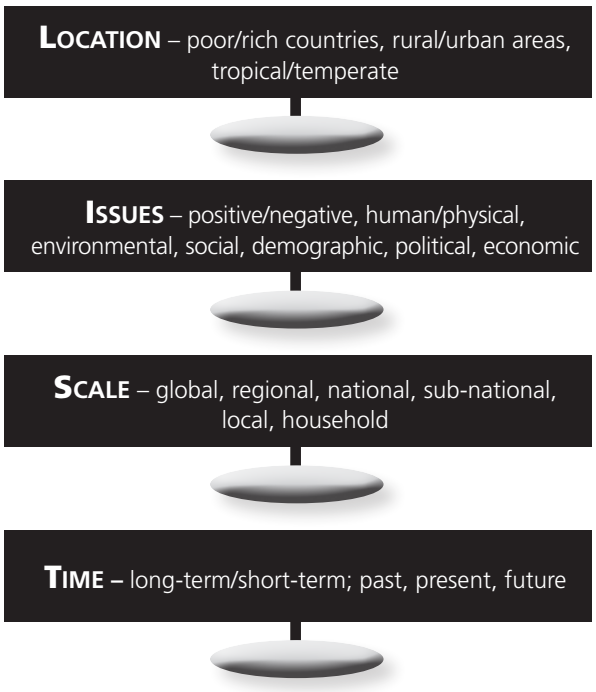
In this exam you will have one hour to answer the question, which appears as parts (a) and (b). These may be linked to the same topic, for example Human development and diversity, or may be independent. Either way, you should approach the two parts separately and assume that the examiner will not cross-credit them, i.e. transfer marks from one to the other if information is misplaced.

INTERPRETING THE ESSAY TITLE

1. Underline the keywords in the title.
2. Go through the checklist below to check each aspect against your essay title to see if it is relevant or not. This will ensure that you give the essay title its broadest interpretation. The title may be brief and leave you to think creatively and to comment on specific aspects of the subject which are not actually mentioned in the title but which are relevant to it. For example, if the question asks you to comment on the global variation in fertility rate, you would need to write about variations in time as well as space.

Checklist

Note that not all the items in this checklist will be relevant to your essay.



PLANNING

Planning is important. Reasons why you should plan your essay include:

- it allows you to order your thoughts before writing.
- you can return to the essay plan and insert new points as you get inspiration while writing.
- it presents a logical sequence of ideas that the reader can easily follow.
- examiners have little time and will credit a well-structured answer that is easy to follow.
- it allows you to focus on the question and make sure that the content is relevant.

STRUCTURE OF THE ESSAY

Introduction

The introductory paragraph gives an interpretation of the title, defines terms, indicates the slant or the direction of the argument and generally sets the scene.

The main body of the essay

Make sure that each paragraph in this part of your essay presents a distinct point or idea. The opening line of each paragraph should clearly indicate its content. The remainder of the paragraph elaborates on that point.

Examples, case studies and illustrations, such as sketch maps and diagrams, should appear in this section.

Conclusion

Here you should return to the essay title and provide an overview of your response. The conclusion should not contain new ideas; it should round off an argument and summarize the key features of the content.

THE LANGUAGE OF IB EXAMS

It is recommended that you become familiar with the command words and other terms listed and defined below. They are all found in IB geography exam questions – misinterpretation costs marks.

Analyse	break down in order to bring out the essential elements or structure
Annotate	add brief notes to a diagram or graph
Classify	arrange or order by class or categories
Compare	give an account of the similarities between two (or more) items or situations, referring to both (or all) of them throughout
Compare and contrast	give an account of similarities and differences between two (or more) items or situations, referring to both (or all) of them throughout
Construct	display information in a diagrammatic or logical form
Contrast	give an account of the differences between two (or more) items or situations, referring to both (or all) of them throughout
Define	give the precise meaning of, for example, a word, phrase, concept or physical quantity

Describe	give a detailed account
Determine	obtain the only possible answer
Discuss	offer a considered and balanced review that includes a range of arguments, factors or hypotheses. Opinions or conclusions should be presented clearly and supported by appropriate evidence
Distinguish	make clear the differences between two or more concepts/items
Draw	represent by means of a labelled, accurate diagram or graph, using a pencil. A ruler (straight edge) should be used for straight lines. Diagrams should be drawn to scale. Graphs should have points correctly plotted (if appropriate) and joined in a straight line or smooth curve
Estimate	obtain an approximate value
Evaluate	make an appraisal by weighing up the strengths and limitations
Examine	consider an argument or concept in a way that uncovers the assumptions and interrelationships of the issue
Explain	give a detailed account, including reasons or causes
Identify	find an answer from a number of possibilities
Justify	give valid reasons or evidence for an answer or conclusion
Label	add labels to a diagram
Outline	give a brief account or summary
State	give a specific name, value or other brief answer without explanation or calculation
Suggest	propose a solution, hypothesis or other possible answer
To what extent	consider the merits or otherwise of an argument or concept. Opinions and conclusions should be presented clearly and supported with empirical evidence and sound argument

Source: *Adapted from the Geography Subject Guide, IBO*

Exam-speak – common terms that confuse

Verbs

Referring to	mentioning or using
Influence	the effect of one thing upon another
Modify	change
Respond to	take action

Nouns

Outcome	consequence/result
Benefits/advantages	positive outcomes
Costs/disadvantages	negative outcomes
Impacts/effects	usually dramatic outcomes
Issues	important and controversial results
Problems	difficulties
Pressures/conflicts	undesirable competition
Challenges	difficulties which may be overcome
Opportunities	potential benefits
Trend	change over time (on a graph)
Pattern	distribution in space
Feature	a distinct part, e.g. a cliff is a coastal feature
Process	the actions or changes that occur between parts
Relationship	a two-way interaction

Adjectives

Global	the whole world
Regional	global regions, e.g. Asia-Pacific
National	belonging to one country
Local	the immediate area or district
Possible	likely to happen
Probable	very likely to happen
Economic	relates to business, finance, employment
Social	relates to human welfare e.g. housing and health
Cultural	relates to language, customs, religion and moral codes
Political	relates to the actions of governments
Demographic	relates to populations e.g. fertility rate
Environmental	relates to the physical environment