Now Test Yourself: Answers

Part 1: Our natural world
Topic 1: Global hazards

Page 9
1. At which line of latitude do the Polar and Ferrel cells meet?
30°.

2. Would an air pressure of 1036 millibars be high or low pressure?
High pressure.

3. Which circulatory air cell is the smallest?
Polar cell.

4. Which circulatory cells meet at the Equator?
The two Hadley cells.

5. Why might the climatic conditions be unsettled around 60° latitude in the northern and southern hemispheres?
The relatively warm air of the Ferrel cell rises along the border of the cold air in the Polar cell. This can bring unsettled weather and regular low-pressure systems bring cloud and rain.

Page 10
1. Which climate zone is found where Hadley and Ferrel cells meet?
Subtropical climate.

2. Brazil and Malaysia are examples of which climate zone?
Tropical.

3. Why do deserts form at 30° north and south of the Equator?
Deserts form because the air is sinking, creating high pressure on the ground beneath it. The daytime temperatures can reach 40°C.

Page 12
1. Where is the hottest place on Earth and what temperature was measured there?
Al-Aziziya in Libya, with a temperature of 57.8°C recorded in 1922. Note the fact that it is located at 32° latitude, where we know that air is sinking at the meeting of the Hadley and Ferrel cells in the sub-tropical high region.

2. Why is rainfall low in the Atacama Desert?
The rainfall is as low as 15 mm per year due to the fact that the desert is in the rain shadow of the Andes mountain range. On the western side of the Andes, there is not enough warmth to pick up moisture from the ocean surface and any rain that does form falls on the west, so there is no rainfall on the east of the mountains.

3. How are the winds in Wellington, New Zealand, intensified?
There are steep mountains either side of Wellington which help to funnel the winds through the city.

Page 14
1. List five key features of tropical storms.
   - Winds need to be travelling at the same speed in the upper and lower atmosphere (wind shear) to prevent the storm being torn apart.
   - Wind speeds of 119 km per hour (75 mph).
• They occur between 5° and 15° north and south of the Equator.
• Warm water from the oceans – surface temperatures need to be more than 26.5 °C.
• Ocean depths of 50–60 m.
• 500 km away from the Equator where the Coriolis effect can cause the weather system to rotate.
• The eye wall is 15–30 km from the centre of the storm.
• At 16 km in height, the winds are deflected outwards and the system spins with the Coriolis effect.

2. To what extent are tropical storms increasing in frequency?
Tropical storms that form into hurricanes have increased in energy over the last 30 years by 70%. El Niño can change the frequency of tropical storms around the world (teleconnections), increasing their frequency in the eastern part of the South Pacific but decreasing their frequency in the Atlantic. Scientists disagree as to whether climate change has altered the frequency of tropical storms.

3. Draw a diagram to show the formation of a tropical storm.
Replicate Figure 9.

---

Page 15

1. Explain how human factors can make the effects of a drought worse.
   • Excessive irrigation.
   • Deforestation – reduces transpiration and therefore rain.
   • Overgrazing exposes soils to wind erosion.
   • Dam building deprives other areas of water.
   • Intensive farming practices.

2. What is the ITCZ and how can it cause a drought?
Inter-tropical convergence zone (ITCZ) is a low-pressure belt that circles the globe near to the Equator and brings rain, where the trade winds meet. The Earth is tilted in its orbit, which causes the ITCZ to move between the two tropics. Sometimes it does not move as far north or south, depriving regions of their usual rainfall, resulting in drought conditions.

---

Page 18

1. Describe one social, one economic and one environmental consequence of drought in Australia.
   Social:
   • The population of the cities increased as people left drought-stricken rural areas.
   Economic:
   • Farmers had to sell their cattle.
   • Food prices increased as the country became more dependent on imports.
   • Water bills rose by 20% in 2008.
   • 10,000 people directly employed in the cotton-growing industry were affected.
   • The number of dairy farms reduced by 50%.
   Environmental:
   • Soil erosion and loss of vegetation.
   • Increase in fossil fuel use as energy from HEP was reduced.
   • Toxic algal outbreaks in depleted rivers and lakes.

2. Choose two responses at different scales from Figure 14. Explain how they would help to reduce the effects of the drought.
Using grey water (recycled from showers and wash basins) would help to reduce the effects by conserving and reusing water supplies within the home. This water can be used on parched gardens and in toilets and for other household needs. This reduces the reliance on water reserves from reservoirs.
A new desalination plant would be very costly but would help to reduce the effects of drought by providing freshwater for struggling communities, including households and farmers.
Page 19

1. Explain how the Boscastle flood was caused by a combination of human and physical factors.

Physical factors:
- Torrential rain – 60 mm in two hours.
- Unusually heavy rainfall linked to Hurricane Alex.
- High land forced the warm, moist air to rise rapidly, leading to dense cumulonimbus clouds forming.
- Saturated ground from the rain in previous weeks led to surface runoff.
- Boscastle is at the confluence of three rivers, including the Valency and the Jordan.
- Steep hills caused the water to funnel into the river valley.
- Small river basin.

Human factors also contributed to the hazard event:
- Linear layout of the village with houses either side of the narrow river.
- Low-lying bridges that were blocked by debris, causing the water to find a new route.
- Old sewer system that could not cope.

2. Sort the consequences of the flood shown in Figure 15 into social, economic and environmental.

Social:
- 84 cars recovered.
- 1000 tourists and residents affected.
- No major injuries or loss of life.
- 58 properties flooded.

Economic:
- More than 20 hotels and B&Bs forced to shut.
- £2 billion damage to infrastructure.

Environmental:
- Trees uprooted and carried downstream.
- Four bridges washed away.

3. Which of the responses do you think are the most and least sustainable?

Reinstating meadows is sustainable as a meadow is a permeable surface, allowing water to soak through and be stored and released more slowly into the river channel. It is also sustainable as it uses natural materials and will not be costly in the long term, whereas some of the hard engineering solutions such as the culvert will need to be maintained over time.

The use of sandbags was relatively unsustainable in the short term as the water was too overwhelming for the small fishing village.

Page 20

1. Describe how heatwaves can bring both positive and negative consequences.

Positives:
- Sales of products increase in the shops, including barbecues by 67%.
- Increased trades associated with tourism, e.g. packed beaches in Brighton.

Negatives:
- Train tracks begin to buckle and road surfaces start to melt.
- Car breakdown call-outs increase by 14%.

2. Describe how a high-pressure system can lead to a heatwave (use information from page 9 to help you with this question).

Hot air was drawn into the UK from a high-pressure system that was over central and southern Europe. The sinking air in a high-pressure system brings calm, dry and hot conditions, leading to a temperature of 36.7°C being recorded in London.

Page 22

1. How did the geography of the Philippines contribute to the disaster?
Usually, a tropical storm loses energy when it reaches land as it is no longer fuelled by the waters of a warm ocean. In the case of the Philippines, the 7000 small islands were not big enough to reduce the energy. Many of the islands are also very low-lying, making the flooding associated with the 5 m storm surge more severe.

2. How are the consequences linked to the economic development of the Philippines (an EDC)?
The Philippines is regularly affected by a range of natural hazards, including typhoons, which affects its ability to develop economically. Typhoon Haiyan affected the primary industries that the Philippines’ economy is based on, such as fishing and coconut trees. Furthermore, 130,000 tonnes of rice were ruined, which might otherwise have been exported to other countries, generating an income for the Philippines. The total economic damage of the storm amounted to $2.86 billion.

3. Which were greater, the social or economic consequences? Justify your answer.
(You could create an argument either way for this question)
Social consequences included 90% of houses in Tacloban being demolished, 670,000 people made homeless, 6300 people died, 11.5 million people affected in total.
Among the economic consequences were industries being devastated, including rice farming (130,000 tonnes ruined), coconut trees and fishing, with an estimated economic damage of $2.86 billion.

Page 24
1. Why do convection currents occur in the mantle?
The hot core (6000 °C) heats the magma. This heat makes the magma less dense so it rises in the mantle towards the crust. As the magma rises it cools towards the crust. The magma becomes denser and sinks back towards the core. This causes convection currents in the mantle.

2. Using the map in Figure 2:
(a) Identify where there are conservative boundaries.
Along the north-west coast of New Zealand between the Indo-Australian plate and the Pacific plate.
On the west coast of North America between the North American plate and the Pacific plate.

(b) What type of plate margin is found between the UK and the USA?
Constructive or divergent plate margin.

Page 26
1. Which plate boundaries experience:
(a) earthquakes
All plate boundaries.

(b) volcanoes?
Constructive and destructive.

2. How are the plates moving at the following plate boundaries:
(a) constructive
Plates move away from each other or diverge.

(b) destructive
Plates move towards each other or converge.

(c) collision
Plates move towards each other or converge.

(d) conservative?
Plates slide parallel past each other.
3. Where can volcanoes be found other than at plate boundaries?
   Hotspots.

Page 28
1. What type of plate boundary does a shield volcano form on?
   Constructive.

2. Describe the lava at a composite volcano.
   The lava is more viscous and sticky.

3. Why do hotspot volcanoes form in a chain?
   The oceanic plate is not static. It keeps moving away from the hotspot so magma stops feeding into the volcano. It becomes extinct. A new volcano then forms creating a chain of volcanoes. The further from the hotspot an island is, the older it is.

Page 29
1. Which plate boundary is Eyjafjallajökull found on?
   It lies on a constructive plate boundary of the North American and Eurasian plates.

2. What does ‘hazardous’ mean?
   A danger or risk to people and the environment.

3. What were the indicators that an eruption was imminent?
   19 March 2010: increasing seismic activity was monitored. Earthquakes became more frequent and shallower as magma rose.
   20 March 2010: lava erupted through fissures. Ash began to be deposited on the surface of the glacier as lava broke through the ice. An increase in silica and gases meant magma was more viscous and explosive.
   12 April 2010: a second fissure ripped open and lava began flowing again.

4. Identify two local and two international consequences.
   Local:
   - Twenty farms were destroyed.
   - Increased local revenue generated by stranded tourists.
   - Respiratory health problems for animals and humans.
   - Melting glacial ice destroyed parts of Iceland’s Route 1.
   International:
   - The international economy suffered as the ash cloud cancelled 95,000 flights worldwide.
   - Passengers and cargo were stranded.
   - Airlines lost $200 million a day.
   - Stock market shares in air travel agencies dropped four per cent.
   - Kenya lost $3.5 million in cancelled trade and perishable food decaying.
   - Europe lost $2.8 billion in insurance costs and lost trade.
   - Increased use of Eurostar, train services, ships and ferries.
   - Petrol prices in the UK and Europe increased as oil industry lost income with 1.87 million barrels of unused air fuel.

5. Why was evacuation necessary?
   Local farm residents and animals were at risk from the ash cloud so were evacuated to reduce ash inhalation causing respiratory problems. Ice melting caused risk of flash flooding and hence loss of life.

Page 30
1. What makes predicting an earthquake difficult?
   Predicting the time, date and exact location of an earthquake is extremely difficult as there is little warning.
2. How is media used to save lives in hazard zones?
Media, especially social media, is used to distribute information immediately and automatically to inform people of the risks and to advise how best to respond, such as turning off utilities or evacuations.

3. Name three indicators that a volcano is soon to erupt.
- There is deformation of ground as magma rises inside the volcano.
- Earthquakes increase in frequency and become shallower as the magma rises, causing plate movement.
- Ground and river temperatures increase.
- Radon and sulphur gas increase.

**Topic 2: Changing climate**

**Page 31**

1. When did the Quaternary period start?
The Quaternary period started 2.6 million years ago.

2. How has temperature changed during the Quaternary period?
During the Quaternary period there has been climate change. Temperatures have fluctuated wildly, but overall have gradually cooled. There have been cold ‘spikes’, which are known as glacial episodes. In between each cold spike are warmer inter-glacial episodes.

3. What is different about the inter-glacial episode that we live in today compared to other inter-glacial episodes?
The inter-glacial episode that we live in today has a higher average temperature than almost all of the Quaternary period.

**Page 32**

1. List the different ways in which evidence about climate change is collected.
Since 1914 the Met Office has recorded reliable climate change data using weather stations, satellites, weather balloons, radar and ocean buoys. Past climate change is worked out using evidence from sea ice positions, ice cores, paintings, diaries and global temperature data from ground weather stations and satellite information.

2. How do paintings show evidence of climate change?
Several artists captured much colder winter landscapes in Europe and North America in the seventeenth century. Cave paintings of animals in France and Spain between 11,000 and 40,000 years ago show significant climate change.

3. Give one problem with using the following as evidence for climate change:
   (a) sea ice position
   Data recording only goes back a short period of time.

   (b) global temperature data.
   - Weather stations are not evenly distributed, especially in Africa, so reliability could be questioned.
   - Computer programmes used to produce global temperature maps does not necessarily make them reliable.
   - Data only goes back to 1880.

**Page 33**

1. Identify two natural factors causing climate change.
- Sun spots.
• Volcanic eruptions.
• Milankovitch cycles.
• Axial tilt.

2. What is in a volcanic eruption that reduces global temperatures?
Volcanic eruptions throw huge quantities of ash, gases (including sulphur dioxide) and liquids into the atmosphere. When sulphur dioxide mixes with water vapour it becomes a volcanic aerosol. Volcanic aerosols reflect sunlight away reducing global temperatures.

3. Why can volcanic eruptions cause lower temperatures in other regions away from the volcano?
Wind carries material far beyond where it was ejected from the volcano, so the reduced temperatures are also experienced elsewhere.

4. What takes:
(a) 11 years
Sun spots increase from a minimum number to a maximum number in a sun spot cycle of about every 11 years.

(b) 26,000 years
The Earth is not a perfect sphere; as the Earth spins it wobbles on its axis in a 26,000-year cycle.

(c) 41,000 years
The Earth spins on its tilted axis. The angle of the tilt changes due to the gravitational pull of the Moon. The angle of the tilt moves back and forth every 41,000 years.

(d) 100,000 years?
The Earth’s orbit is elliptical and it changes shape every 100,000 years. This means as the Earth orbits closer to the Sun, the climate becomes warmer.

Page 35
1. Name the greenhouse gases.
Carbon dioxide (77%), methane (14%), nitrous oxide (8%), and chlorofluorocarbons (CFCs) (1%).

2. Why does the Earth need the natural greenhouse effect?
The natural greenhouse effect is needed on Earth because it keeps the Earth warm enough for life to exist. Without it the Earth would be about 33°C colder.

3. Identify two human activities thought to be causing climate change.
• Burning fossil fuels used in transportation, building, heating homes, in power stations, and the manufacturing industry.
• Agriculture – especially cattle rearing and rice production.
• Deforestation.
• Decay of organic waste in landfill sites.

4. Name the fossil fuels.
Coal, oil and gas.

Page 36
1. How are the effects of climate change expected to be distributed across the globe?
They are likely to be unevenly distributed across the world and will depend on the human and physical circumstances of the location. For example, low-lying coastal countries will be more vulnerable to effects such as flooding and poorer countries will be more vulnerable with less ability to invest in prediction and protection strategies.
2. Name one social, one economic and one environmental effect of rising sea levels.

Social:
- Increase in the number of environmental refugees due to flooding (for example, Tuvalu and Vanuatu).
- Job losses in fishing or tourism, so have to learn new skills.
- Migration and overcrowding in low-risk areas due to flooding (for example in Asia).

Economic:
- Valuable agricultural land lost to the sea or polluted by seawater (for example, Bangladesh and Vietnam).
- Many world cities, which are important financial centres, including New York and London, could be affected by flooding.
- Transport infrastructure damaged by flood water.
- Investment in coastal defences required as UK’s current defences under increased pressure from sea level rise.
- Loss of income from tourism as beaches eroded or flooded. Hotels forced to shut.

Environmental:
- IPCC estimate up to 33% of coastal land and wetlands could be lost in the next 100 years.
- Biodiversity lost due to damage by storms and bleaching in coral reefs (for example, the Great Barrier Reef).
- Mangrove forests, which form natural barriers to storms, are damaged (for example, the Pacific Islands).
- Fresh water sources polluted by salty seawater.
- Adélie penguins on the Antarctic Peninsula may decline as ice retreats.

3. Name one social, one economic and one environmental effect of extreme weather events.

Social:
- Increased drought, affecting farming and water supplies (for example California 2012–17).
- Increased risk of diseases, such as skin cancers and heat stroke, as temperatures increase.
- Winter-related deaths decrease with milder winters.

Economic:
- Extreme weather increases investment in prediction and protection.
- Flood risk increases repair and insurance costs (for example, damage of US$9.7 billion in Pakistan in 2010).
- Maize crop yields decrease by up to 12% in South America; they will increase in northern Europe but require more irrigation.
- Skiing industry may decline in Alps as less snow.

Environmental:
- Forests experience more pests, disease and forest fires (for example, South East Australia had worst bushfires on record in 2009).
- Lower rainfall causes food shortages for orangutans in Borneo and Indonesia.
- Flooding in South Asia increases rice yields.

4. Give one positive and two negative effects of climate change.

Positive:
- Flooding in South Asia increases rice yields.
- Maize crop yields will increase in northern Europe.
- Winter-related deaths decrease with milder winters.

Negative:
- Lower rainfall causes food shortages for orangutans in Borneo and Indonesia.
- Maize crop yields decrease by up to 12% in South America.
- Increased risk of diseases, such as skin cancers and heat stroke, as temperatures increase.

Page 37
1. How is rainfall and temperature changing in the UK as a result of climate change?
Summers are expected to become drier, but winters will receive an increase in rainfall. Some rivers will flood more frequently in winter. Temperatures are set to increase, but increases are expected to be greater in the south of the UK.

2. **How are seasons in the UK changing as a result of climate change?**
Spring is expected to arrive earlier and autumn start later. Precipitation is expected to become even more seasonal.

3. **Is the risk of coastal flooding expected to increase or decrease as a result of climate change?**
The UK is expected to be at a greater risk of coastal flooding due to sea level rise.

4. **State three examples of changes in industry in the UK as a result of climate change.**
   - Teesside industries on coastal mudflats will be vulnerable to flooding due to sea level rise.
   - Agricultural land may be lost due to managed retreat in managing sea level rise.
   - Tourism industry adversely affected by eroded beaches.
   - The summer heat increases the tourist industry in the Lake District, generating jobs and increased revenue.
   - The Cairngorms ski resorts may be forced to close, reducing revenue.

5. **List two social and two environmental impacts of climate change in the UK.**
   **Social:**
   - Cliff collapse may increase, putting properties at risk.
   - The UK’s elderly will be more vulnerable during heatwaves, but will suffer fewer cold-related deaths in winter.
   - Heating costs will reduce.
   - Water shortages would be experienced by many by the 2050s.

   **Environmental:**
   - Bird migration patterns shift.
   - Some trees and plants flower earlier and others later.
   - Wildlife species could struggle to survive if the seasons doesn’t match up with their food supply.
   - Vegetation and ecosystems will move north. Sitka spruce yield may increase in Scotland and new crops such as peaches and oranges could be cultivated in southern England.
   - The agricultural productivity may increase under warmer conditions, yet require increased irrigation.
   - Salt marshes may become flooded and eroded, but managed retreat could create new salt marsh habitats.

---

**Topic 3: Distinctive landscapes**

**Page 38**

1. **Define the term ‘landscape’**.
   ‘Landscape’ describes the visible features that make up the surface of the Earth.

2. **Explain the difference between a natural landscape and a built landscape**.
   A natural landscape has been sculpted by natural processes only whereas a built landscape involves human-built environments (e.g. cities).

3. **Explain why there are few truly natural landscapes in the UK**.
   Most UK landscapes have been modified in some way by people.

**Page 40**

**Describe the formation and landscape characteristics of igneous, sedimentary and metamorphic rocks.**
Igneous rocks form from the cooling of molten magma. They are tough and resistant to erosion.
Sedimentary rocks form from the accumulation and compaction of sediments. Some rocks are resistant, such as limestone, whereas others are weak, such as clay. Metamorphic rocks have undergone a change due to extreme heat and/or pressure. They are usually tough and resistant to erosion.

Page 42
1. What is the difference between mechanical and chemical weathering?
Mechanical weathering involves rock disintegration without any chemical alteration, whereas chemical weathering involves chemical change.

2. Outline the process of freeze–thaw weathering.
Water soaks into cracks in a rock. It freezes to form ice and expands creating stresses within the rock. Through repeated cycles of freezing and thawing, the rock becomes weakened further and fragments break away.

3. How does the action of plant roots cause weathering to rocks?
As plant roots grow within rocks they prise open cracks causing rock fragments to break away.

Page 43
Use Figure 4 to describe the causes and characteristics of slumping.
Slumping is usually caused when weak rocks become saturated with water following heavy rainfall. These rocks can be made more unstable by undercutting and freeze-thaw weathering. The increased mass (water) and its lubricating effect leads to the cliff slumping. This often results in a series of curved slip planes with displaced sections of the cliff forming steps down to the beach.

Page 45
Explain the formation of an arch.
An arch is formed when two caves are eroded back to back at a coastal headland. When the sea erodes through the backs of the caves, they form an arch.

Page 46
Suggest reasons why some stretches of coastline have sandy beaches.
Sandy beaches are formed in sheltered bays and are usually associated with low-energy waves (high-energy waves usually remove the sand from beaches). Constructive waves are responsible for building up extensive sandy beaches.

Page 48
Draw a sketch cross profile from X to Y on Figure 12 and explain the formation of the features of erosion and deposition.

![Sketch cross profile](image)

The line of fastest flow (velocity) is largely responsible for the features of erosion and deposition. At the outside bend, the faster flow erodes the river bank to form a river cliff. The slower rate of flow on the inside bend results in deposition and the formation of a slip-off slope.
**Page 49**

**Describe the formation of an oxbow lake.**

Having formed an elaborate looping meander, during a period of high flow (flood) the river breaks through the meander neck, cutting off the meander. The river now adopts the shorter (steeper) course and deposition at the sides of the river starts to infill the old meander. It is the old cut-off meander that forms an oxbow lake.

**Use a series of simple diagrams to explain the formation of a levee.**

Use diagrams similar to Figure 15 with explanation. When a river overtops its banks, sediment is deposited on the banks. Over time and repeated flooding, the banks become raised to form levees.

**Page 53**

1. **Outline the impacts of geology on the geomorphic processes operating on the North Norfolk coast.**

   The chalk in the cliffs to the north are exposed and subject to weathering. Otherwise they are quite resistant to erosion. Elsewhere, the weaker glacial deposits are easily eroded by the sea and subject to significant mass movement (slumping).

2. **Use Figure 18 to identify the factors responsible for shaping these cliffs on the North Norfolk coast.**

   Despite the weak geology, glacial till forms cliffs along the coast. The narrow beach means that the cliffs are exposed to powerful waves from the north-east (maximum fetch). The waves undercut the cliffs and erode the sediment which is transported southwards by longshore drift.

**Topic 4: Sustaining ecosystems**

**Page 56**

1. **Explain how plants are dependent on the soil.**

   Plants take up nutrients from the soil.

2. **Explain how animals are dependent on the climate.**

   Reptiles need warmth to survive.

3. **Explain how the climate is dependent on plants.**

   Plants give out oxygen.

**Page 59**

1. **Give five examples of how plants and animals from any biome have adapted to survive in their environment.**

   Example: Desert.
   - Most plants are xerophytic, which means they have adapted to the lack of water – for example, cacti.
   - Plants such as yuccas have roots near the surface of the ground to absorb any water that falls.
   - Camels have humps to store water and fat and eyelashes to keep out the sand.
   - Meerkats are immune to scorpions and eat them as part of their diet.
   - Sidewinder snakes do not keep all of their body in contact with the sand to avoid the heat.

2. **Describe how temperature and rainfall vary between each of the biomes.**

   It is hot and wet in the tropical rainforest near to the Equator where there are no seasons and high monthly temperatures of between 26°C and 28°C and the highest rainfall of any of the biomes at more than 2000 mm per year. The desert has higher daytime temperatures of 36°C, but it can fall to below freezing during the night. Rainfall is considerably lower at around 40 mm. The temperate forests have four distinct seasons, with warm summers and mild winters and rainfall that ranges from 750 mm to 1500 mm.

3. **How does the position of the ITCZ affect patterns of rainfall in tropical grasslands?**
Tropical grasslands experience wet and dry seasons. The ITCZ brings the wet season, in which 80% of the rain falls in just 4–5 months of the year.

4. State two places in which you would find:
   (a) hot deserts
   The Sahara in northern Africa and the Mojave in North America.
   (b) tropical rainforests.
   The Amazon River Basin in South America and SE Asia and Queensland, Australia

5. Why is there such a large range of temperatures across 24 hours in the hot desert?
   There is a lack of insulating cloud cover during the night, allowing the heat from the day to escape into the atmosphere. Also, the ground absorbs a lot of heat during the day and cools at night.

Page 60
1. What are the similarities between the Arctic and Antarctica?
   Both regions have long, cold winters and short, cool summers. They are covered in snow and ice throughout the year. Temperatures are rarely above freezing due to the low angle of the sun. Each pole spends half the year in darkness due to the tilt of the Earth. Polar regions are dry, receiving 250 mm of rainfall per year.

2. Explain two reasons why Antarctica is colder than the Arctic.
   There are circumpolar winds that travel around the continent and there is a mountain range across Antarctica, with heights of 2300 m. Temperature decreases with altitude. The Gulf Stream also helps to keep the Arctic warmer.

3. Why do trees not grow in the Arctic?
   The ground is permanently frozen (permafrost), which makes it hard for anything taller than mosses and grasses to grow.

4. Why are there more animals than plants in the poles?
   The seas around the poles are rich in phytoplankton, which is the keystone species and underpins the food chain for larger species such as whales. Some bird species and mammals such as whales are able to migrate southwards during the winter months.

Page 61
1. What environmental conditions are needed for coral to grow?
   Coral needs warm water all year round, with a mean temperature of 18°C. The water needs to be clear and shallow (no deeper than 30m) for photosynthesis to occur.

2. Name two places in the world where coral reefs are found.
   Gulf of California; western Atlantic Ocean, including Florida and Bermuda; Red Sea and Persian Gulf; Great Barrier Reef.

3. What are coral reefs made of?
   An animal related to the jellyfish. They make their own skeleton from calcium carbonate.

Page 63
1. Name two minerals found in the soil of tropical rainforests.
   Magnesium, aluminium oxide and iron oxide.

2. What is the term for the type of rainfall in the rainforest?
   Convectional rainfall.

3. Why is decomposition of the litter layer so rapid?
Because the conditions are hot and damp; the leaves break down quickly.

4. The soil is surprisingly infertile – why?
As soon as nutrients are released from the litter into the soil, they are taken up by nutrient-hungry plants and trees.

Page 66
1. Why do logging companies argue that their industry is not as damaging as others?
Logging companies argue that they selectively cut down and remove the trees they want. However, in doing so, they often damage the surrounding trees.

2. Why is cattle ranching common in South American countries?
It is relatively low risk and low maintenance in comparison with growing cash crops such as palm oil. It is not vulnerable to changes in global prices or climate change. There is also a high demand for meat products from the nearby USA, helping to sustain the market.

3. Why are palm oil plantations so destructive to the environment?
Large areas of land have to be cleared for palm oil plantations. The process of clearing the land involves cutting down the trees and burning them to release nutrients from the ash into the soil, which also releases harmful CO₂ into the atmosphere. The nutrients released are short term and enough for the palm trees. Once the palm trees and their oil have been harvested, the land is left infertile and useless.

Page 69
What are the distinctive characteristics of the Antarctic?

<table>
<thead>
<tr>
<th>Climate</th>
<th>Extreme cold, with winter temperatures dropping below −50°C. Cold, dry and very strong winds blowing out from the centre of the continent.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Features of land and sea</td>
<td>99% covered by ice, the rest being bare rock. Transantarctic mountains stretch for 3500 km through the centre of the continent rising to 5000 m. Several ice shelves extending out to sea.</td>
</tr>
<tr>
<td>Flora and fauna</td>
<td>Very few species of plant able to survive the extreme weather and surface conditions – two species of grass, lichens and algae. Penguins nest on ice shelves. Marine life is abundant due to the nutrient rich waters.</td>
</tr>
</tbody>
</table>

Page 70
Suggest reasons why the Arctic shows greater biodiversity than the Antarctic.
Greater biodiversity in the Arctic because conditions are less extreme than in Antarctica, especially around the edges. Land areas have some soil development so will have a greater variety of plants and these will support animals (e.g. Arctic fox). Deep snow provides shelter for some animals. In the summer, temperatures will rise above freezing in places.

Page 71
Outline some of the harmful impacts of scientific research on Antarctic ecosystems.
Several ways in which scientific research has impacted on ecosystems – pollution due to waste, sewage, oil; introduction of alien species such as spiders, moss and fruit flies; possible impact of activities on magnetic field which may affect plants and animals.

Page 72
Describe the impacts that mineral extraction can have on polar ecosystems.
Oil spills have caused harm to coastal ecosystems, e.g. Exxon Valdez in 1989, which killed thousands of seabirds and animals. In Siberia, oil spills have damaged forest ecosystems and freshwater lakes.

Page 73
Describe how fishing can impact on Arctic ecosystems.
Overfishing can cause marine ecosystems to become unbalanced, especially if young fish are caught. Fish stocks can collapse.

**Part 2: People and society**

**Topic 5: Urban futures**

**Page 80**

1. **What are the two causes of rapid population growth in LIDC cities?**
   Rural–urban migration (people moving from the countryside into the city) and internal growth (people having children within the city)

2. **What are the environmental push factors from villages?**
   Crop failure; natural disasters such as drought and flooding; lack of clean water

3. **What are the economic pull factors into the cities?**
   Greater range of employment with higher wages; more transport networks to access work; better education to access better paid work; stable government

**Page 83**

1. **What encouraged the movement of people into the suburbs of cities?**
   Public transport and increased car ownership in the mid to late twentieth century meant that commuters could live further away from their place of work in the city. There was also a move to home ownership and people started to buy properties in housing estates on the edges of cities.

2. **What are the push and pull factors involved in counter-urbanisation?**
   **Push factors (from the city):**
   - Traffic congestion.
   - Higher cost of living.
   - Perception of high crime.
   - Poor air quality.
   - Dream of the rural idyll.
   
   **Pull factors (into the countryside):**
   - Good air quality.
   - Less traffic.
   - Low crime rates.
   - More space, including bigger gardens.
   - Better education facilities.
   - Slower pace of life.

3. **Why are cities experiencing re-urbanisation?**
   Government initiatives are encouraging people and businesses back into the city. Grants have been provided to retailers to take on derelict buildings. Young people are moving to the city for university and to find work and they need housing close to amenities. Gentrification has also helped to revive inner-city areas, where housing offers easy access to work and entertainment in the city. Older people sometimes move back into the city to be able to access better health care.

**Topic 6: Dynamic development**

**Page 91**

1. **What are the limitations of using gross national income (GNI) as a measure of development?**
Average figures for a single country can be misleading, masking extremes of wealth and poverty within that country. The informal economy which is significant in poorer countries does not feature in official GNI figures. Data about income is sensitive and people may not always be honest when giving information.

2. Why is life expectancy a good measure of development?
Life expectancy is a proxy measure for life style, service provision, medical support and general health. In this way, it is a good measure of development.

3. Is birth rate a good measure of development?
Birth rate is a reasonably good measure, with poorer countries tending to have high birth rates (due to social and economic needs, lack of contraception, etc.). However, some poor countries do have low birth rates (e.g. Cuba) for political reasons.

4. The Human Development Index is a ‘composite’ index. What does this mean and why does it make the HDI one of the most widely used measures of development?
The HDI reflects several development measures (income, life expectancy and education) which is why it is a composite measure. Developed by the United Nations, it is considered to be a very good overall measure of development.

Page 92

1. How can weather and climate affect economic development?
Extreme weather and climate conditions, for example drought, extreme rainfall (monsoons in Asia and tropical cyclones in the Caribbean, the Philippines, etc.), can hinder economic development due to the resulting devastation and death, reducing the number of people capable of working.

2. Study Figure 5.
(a) Describe the distribution of landlocked developing countries.
The majority of landlocked countries are in Africa and the Central Asia. There are a few landlocked countries in South America, Europe and South East Asia.

(b) Why does the lack of a coastline hinder economic development?
The lack of a coastline affects the development of trading links with other countries and the establishment of ports and fishing settlements.

Page 93

1. With reference to Figure 6, explain why ‘poverty leads to poverty’.
Poverty often leads to inadequate diets and poor health care. Unable to work due to sickness, people’s incomes fall and they fall further into poverty hence the ‘cycle’ of poverty.

2. How has colonialism hindered economic development in many LIDCs?
During the colonial era, many LIDCs were exploited for their resources with limited development taking place. On achieving independence, many of these countries have struggled to develop their economies due to poor infrastructure, and social and political instability.

Page 94

Explain why political unrest makes it hard for some countries to break out of poverty.
Political instability affects the willingness of foreign businesses to invest in LIDCs for fear of losing money. Foreign investment is likely to be limited due to the high risks involved.

Page 96

1. Draw a simplified version of Rostow’s model of economic development.
Draw a simple diagram based on Figure 4, involving line showing positive relationship between time and development split into five stages.
2. Can Rostow’s model be successfully applied to Ethiopia?
Ethiopia can be considered to be in stage 2 of Rostow’s model. Still largely a traditional agricultural society, there are signs of improvements in technology, education and health care. The model suggests rigidity between the stages which may not be the case in reality.

Page 100
1. What are Ethiopia’s major exports and imports?
Ethiopia’s main exports are agricultural products – coffee, food and flowers. Ethiopia’s main imports are petroleum, trucks, fertilisers, construction and wheat.

2. What are the potential problems with an overdependence on the export of agricultural products?
Dependence on export of agricultural products means that the economy is vulnerable to weather/climate events as well as changes in international commodity prices.

3. Why is it important for Ethiopia to have strong trading links with foreign countries?
Strong trading links are evidence of a stable economy and government and will encourage links with other countries. Trading links will support Ethiopia’s future economic development.

Page 103
1. Why do countries such as Ethiopia get into debt?
Countries may fall into debt by borrowing money to fund development, such as petroleum, construction and communications.

2. How can debt relief help Ethiopia to develop its economy?
The investment in transport, communications and services will generate wealth for the country and contribute to its economic growth.

3. Why is borrowing money not necessarily a bad thing?
Borrowing money – if the money is spent wisely – can promote economic development and bring good returns on investments thereby encouraging additional investment. People’s quality of life can improve as a result of economic development.

Page 104
Describe one bottom-up strategy and one top-down strategy in Ethiopia.
Bottom-up: Farm Africa works with rural communities breeding animals such as goats which are then donated to other communities.
Top-down: Growth and Transformation Plan has invested $3.6 billion on improving rural infrastructure to enable industries to develop.

Topic 7: UK in the 21st century

Page 106
Use an atlas map showing the physical geography of the British Isles to answer the following questions.
1. Describe the location of the Cambrian Mountains, the North West Highlands and the North Downs.
Cambrian Mountains (central Wales); North West Highlands (far north-west of Scotland); North Downs (south-east England to the south of London).

2. Describe the course of the River Thames.
The River Thames has its source in Gloucestershire. It flows roughly eastwards through Oxford, Reading and London to reach the North Sea at the Thames Estuary near Southend.
Page 109
1. Use Figure 5 to identify the areas in England suffering from the most serious water stress.
Serious water stress occurs in central southern and south-east England.

2. How can the problem of water stress in these areas be addressed?
To address water stress, water can be transferred into the area via rivers and pipelines from areas of water surplus. Additionally, new reservoirs can be constructed. Water conservation can be encouraged to reduce demand.

Page 110
1. Define the term ‘natural increase’.
Natural increase is the difference between birth rate and death rate. It is usually expressed as a percentage.

2. Name the two factors that determine the ‘total population’ of a country.
Total population is determined by natural increase (or decrease) and migration.

Page 111
Why is the UK in Stage 4 of the DTM?
The UK is in Stage 4 because it has a relatively low but quite steady birth rate and a low death rate. Birth rate still exceeds death rate so the UK has not entered Stage 5.

Page 113
1. Why does the UK have an increasingly ageing population?
The UK has an ageing population because people have access to high-quality medical care and generally enjoy a high standard of life. Due to the ‘baby-boomer’ generation, a large number of people are moving into old age.

2. Identify two government strategies designed to address the issue of an ageing population.
Pensioner Bonds (2015) encourage the elderly to save money to help support their needs. An increase in the pension age reduces the burden of paying pensions and encourages people to work for longer.

Page 114
Why have large numbers of Eastern Europeans moved to Boston?
Large numbers of Eastern Europeans have moved to Boston to work in agriculture because they can earn more money than in their home countries and can support their families by sending money home.

Page 115
1. How did the 2008 global recession affect the UK’s political priorities?
Following the 2008 banking crisis the UK government had to step in to support banks and building societies with public money to prevent them collapsing.

2. Suggest the potential impacts of the UK’s referendum decision to leave the EU.
Following the referendum, the UK entered a period of considerable economic uncertainty. While Brexit offers opportunities for new trade arrangements outside the EU, there are many trading, social and cultural issues to resolve with the EU, such as the movement of goods and people.

Page 116
Suggest why the service sector witnessed significant growth in the period 2001–13.
Service sector has grown due to the expansion of financial and professional services as well as increases in tourism, creative industries, education and health care.

Identify three trends in working hours during the period 2001–11.
Three trends in working hours include: a fall in average hours for both men and women; fathers working less at weekends and in evenings; higher proportion of homes have two people working.
Page 119
1. What is an ‘economic hub’?
Economic hub is a central point or area associated with economic success and innovation, e.g. Silicon Fen in Cambridgeshire or Canary Wharf in London.

2. Outline three characteristics of Oxfordshire’s economic hub.
Oxfordshire’s economic hub: focus is on scientific and technological industries; high-performance engineering, space and medical research are the main industries benefiting from proximity to Oxford University (graduates/research); industries vary from small start-ups to large multinationals.

3. List three recent changes that have taken place in Oxfordshire’s economic hub.
Recent changes include: new developments on the Harwell Campus, including a new space telescope; improvements in local road infrastructure; several mergers have taken place between companies, particularly in the biotech sector.

Page 120
1. What is a conflict zone?
A conflict zone is an area where two or more groups have serious disagreements resulting in military, social or economic aggression.

2. What is the difference between a refugee and a displaced person?
A refugee has been forced to move away from his/her country of origin to seek sanctuary in a foreign country. A displaced person has remained within his/her country of origin but has had to move home.

Page 121
Suggest why Somalia is one of the ‘most unstable places on Earth’.
Somalia is extremely unstable due to social and political tensions in an area where there are many disputes over land ownership between different groups of people. It has been torn apart by decades of civil war and has also suffered from droughts and famines.

Page 122
Give three examples of the global influence of the UK’s media exports.
Examples include: UK architects designing sporting venues such as the cricket stadium in Pune, India; London Design Festival has inspired similar events around the world; many foreign students study creative subjects (design, music, fashion) in the UK and then develop media industries in their home countries.

Page 123
Outline the global influence of three British television exports.
Several UK television programmes have been successfully exported (e.g. Dr Who, Sherlock) particularly to English-speaking countries and China – TV is an important export earner. Some programmes have been re-formatted for local audiences, supporting local actors and technical support staff. Examples of re-formatted programmes include Who Wants to be a Millionaire and The Office. UK television programmes are considered to be of a high quality, helping to set standards in production elsewhere in the world.

How does the UK film industry contribute to the UK’s media exports?
The film industry contributes to the UK’s media exports by selling film rights and in film production (studios, editing, etc.). In 2013, it had a turnover of £6 billion (3.6% of creative industries).
**Topic 8: Resource reliance**

**Page 126**
1. ‘Resources are unevenly distributed across the world.’ Is this statement true or false? Give one piece of supporting evidence.
   True, resources are unevenly distributed. Much of Africa suffers from shortages of water (Figure 2) and food.

2. Explain how population growth, increased consumption and changing technology increase the demand for resources.
   Population growth increases the demand for water, energy and food – more people, more demand. As demand (consumption) increases, this puts increasing pressure on resources. Changing technology can also increase demand for water and energy (such as domestic appliances) in particular.

**Page 127**
1. Briefly outline how the following actions affect ecosystems:
   (a) removal of hedgerows
   Removal of hedgerows destroys valuable ecosystems and disrupts the movement of insects and small mammals who use hedgerows as wildlife corridors.

   (b) overfishing
   Overfishing has threatened some species of fish (such as tuna), depleted fish stocks and caused an imbalance in marine ecosystems.

   (c) use of fine-mesh nets.
   Fine-mesh nets indiscriminately catch fish of all sizes, including young small fish. This means that stocks are not replaced. The nets can also accidently catch dolphins, turtles and seabirds, affecting marine ecosystems.

**Page 128**
1. Why is it so important to retain global forests?
   Forests act as carbon stores, absorbing carbon dioxide from the atmosphere so mitigating harmful carbon emissions (climate change). They are important habitats for plants and animals and play an important role in the water cycle (release of water into the atmosphere).

2. What is fracking and why are some people concerned about its impact on the environment?
   Fracking is the extraction of oil/gas using high-pressure water and chemicals injected into shale rocks. Some people are concerned about pollution of groundwater and the triggering of small earthquakes.

**Page 130**
1. Suggest two issues of environmental concern associated with:
   (a) constructing reservoirs
   Reservoirs can affect the natural flow (speed of flow, for example) of rivers, impacting aquatic ecosystems; ecosystems can be destroyed when land is flooded to form a reservoir.

   (b) water transfer schemes.
   Water transfer schemes can inadvertently spread alien species of plants and animals and cause nutrient imbalances (increase in nutrients can lead to algal growth and eutrophication – deoxygenating the water).

**Page 131**
Look at Figure 1. Where are the areas of greatest food security? Which areas are at greatest risk from food insecurity?
Areas of greatest food security include North America, north-west Europe, Australia and New Zealand. Those areas at risk from food insecurity are mostly in Africa particularly central and eastern Africa. Also parts of the Middle East (Afghanistan) and Caribbean (Haiti).
Explain how climate and conflict can affect food supply.
Climate: droughts can cause food shortages; floods can destroy crops; climate change can lead to more erratic weather patterns and extreme weather events.
Conflict: affects distribution/storage of food causing food shortages; landmines prevent farming; water sources may become polluted.

Briefly outline the differences between the theories of Malthus and Boserup.
Malthus suggested that food supply would not be able to keep pace with population growth – global famines and wars would result. Boserup, however, argued that food production would increase to keep pace with population growth due to technological improvements in agriculture.

1. Look at Figure 7. Describe the changes in UK consumption of fresh potatoes, and fresh fruit and fruit products.
Fresh potatoes: shown a steady decline from about 1,300 grams per person per week in 1974 to about 500 grams per person per week in 2010.
Fresh fruit and fruit products: shown a steady increase from about 700 grams per person per week in 1974 to just under 1,200 grams per person per week in 2010.

2. Name three countries that export food to the UK.
Examples of countries exporting food to the UK are the Netherlands, Spain and France.

For one of the strategies in Figure 9, outline how it can improve food security at the local scale.
Choice of strategy: food banks, urban gardens, allotments:

- More than 1 million people rely on food banks. Food banks provide stores of food for people to access. Vouchers entitle people to three days of food, and advice is given to assist with food security.
- Urban gardens make use of wasteland or other land not used productively to produce food for local people, improving food security. They also promote healthy eating and can provide economic and social benefits too.
- With allotments, local communities improve food security as people grow their own fruit and vegetables, maintaining the land for future generations. Increasingly, young people are tending allotments.

1. What is the ‘Green Revolution’?
Green Revolution: originally a movement in the 1960s to increase food production in poor countries through the use of scientific innovations (new strains of seed and irrigation).

2. Assess the successes and failures of the Green Revolution.
It was enormously successful in increasing food production in countries such as India, averting possible famines as the population grew. However, success depended on expensive seeds and irrigation – wealthy farmers benefited more than peasant farmers, increasing the wealth gap. Some labouring jobs were lost as machines took over from people on farms. As food prices fell (good for consumers) smallholder farmers’ incomes were reduced.

3. How is selective breeding different from genetic modification (GM)?
Selective breeding involves cross breeding in animals and plants to maximise production, e.g. milk. GM involves scientifically altering DNA in a laboratory; it is more scientific and invasive.
4. Suggest why GM crops are not grown in the UK.
In the UK there is concern about the environmental impacts on human health, the gene pool and natural ecosystems.

Page 138
1. What is Fairtrade?
Fairtrade is a global movement that started in 1988 and guarantees farmers a fair price for their agricultural products.

2. How does the social premium benefit Fairtrade farmers and their communities?
Produce sold under the Fairtrade label pays farmers a fair price and helps to support local rural communities (education, infrastructure, etc.) – this is the social premium.

3. Why is so much food wasted in developed countries?
Food waste occurs when consumers (often supermarkets) refuse to buy misshapen fruit/vegetables or when consumers fail to use the food that they have bought. ‘Sell by’ and ‘Best before’ labels often confuse people about food safety also resulting in food waste.

Page 139
1. What are the main characteristics of organic farming?
Organic farming does not use chemicals, such as pesticides and artificial fertilisers. It is labour intensive and, as a result, its produce can be more expensive in the shops.

2. In what ways is intensive farming unsustainable?
Intensive farming can be unsustainable in that it can damage soils; increase the risk of pests and diseases (if grown as monoculture); pollute water supplies with chemical runoff; cause water tables to fall if over-irrigation occurs.

Page 140
1. What is hydroponics?
Hydroponics involves growing plants in a soil-free medium with nutrients being delivered through water.

2. What are the advantages and disadvantages of hydroponics?
Hydroponics can grow food intensively in artificially heated and watered greenhouses. Plants grow quickly and are usually free from environmentally transmitted pests and diseases. However, the use of artificial heat and light is expensive and a great deal of technical knowledge is required. It is not necessarily economically sustainable.

Page 142
1. What is the difference between top-down and bottom-up approaches?
Top-down approaches involve initiatives from government or agencies, whereas bottom-up approaches involve grassroots initiatives than come from ordinary people or community groups.

2. Describe one example of an urban garden.
The Michigan Urban Farming Initiative in Detroit, USA, involves the reclamation of derelict land and its use as garden beds to provide employment opportunities and fresh food for local people.

3. Define ‘permaculture’.
Permaculture promotes ‘natural’ food production by fitting in with the natural environment; it is waste free and in harmony with the natural world with a focus on maintaining soil fertility through practises such as composting.