Global Hazards

Knowledge checklist

<table>
<thead>
<tr>
<th>Key ideas</th>
<th>How secure is my knowledge?</th>
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<tbody>
<tr>
<td>How can weather be hazardous?</td>
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<tr>
<td>Outline of the global circulation system including the effects of high and low pressure belts in creating climatic zones.</td>
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<tr>
<td>How the global circulation of the atmosphere causes extremes in weather conditions in different parts of the world.</td>
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<td>The extremes in weather conditions associated with wind, temperature and precipitation in contrasting countries.</td>
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<tr>
<td>The distribution and frequency of tropical storms and drought, and whether these have changed over time.</td>
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<td>Outline the causes of the extreme weather conditions associated with tropical storms.</td>
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<td>Outline the causes of the extreme weather conditions of El Niño/La Niña leading to drought.</td>
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<td>Case studies of two contrasting natural weather hazard events arising from extreme weather conditions. The case studies must include a natural weather hazard from each bullet point below: flash flooding or tropical storms, heat wave or drought. There must be one UK based and one non-UK based natural weather hazard event.</td>
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<tr>
<td>For each chosen hazard event, study the place specific causes (including the extreme weather conditions which led to the event), consequences of and responses to the hazard.</td>
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How do plate tectonics shape our world?

<table>
<thead>
<tr>
<th>How secure is my knowledge?</th>
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<tbody>
<tr>
<td>The structure of the Earth and how it is linked to the processes of plate tectonics including convection currents.</td>
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<td>The processes that take place at constructive, destructive, conservative and collision plate boundaries as well as hotspots.</td>
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<td>How the movement of tectonic plates causes earthquakes, including shallow and deep focus, and volcanoes, including shield and composite.</td>
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<tr>
<td>A case study of a tectonic event that has been hazardous for people, including specific causes, consequences of and responses to the event.</td>
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<tr>
<td>How technological developments can have a positive impact on mitigation (such as building design, prediction, early warning systems) in areas prone to a tectonic hazard of your choice.</td>
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**The Coriolis Effect:**

- The Coriolis effect causes a deflection in global wind patterns.
- The anticlockwise rotation of the Earth deflects winds to the right in the northern hemisphere and to the left in the southern hemisphere.
- This is the reason that storms like hurricanes appear to spin and why the winds on our Tri-cellular model do not travel directly North or South.

**Extreme temperatures:**

*5 Factors effecting a country's climate*

- **1 – Latitude.** How far north or south you are of the equator. Generally the closer you are to the equator the hotter it is.
- **2 – Altitude.** How far above sea level you are. The higher above sea level you are the colder it is!
- **3 – Distance from the sea.** Places near to the coast have a smaller temperature range than those inland. This is because land heats up and cools down more quickly than the sea.
- **4 – Prevailing winds.** The usual direction the wind blows! If the wind is warm it will get hotter but if it comes from colder areas it will get cooler.
- **5 – Position in wind belts.** There are 6 wind belts in the world. The location of a country in a wind belt can help us predict the climate.
Where in the world?

Facts:

• It is at the southern most point of the earth

• It is the coldest place on earth

• The lowest ever recorded temperature was \(-89^\circ \text{C}\)

• It is bigger than the whole of Europe

• It is a huge desert because it very little precipitation

Why is it so hot?

• The worlds hot deserts can be found in North Africa, the Middle East, south west USA, South America and large parts of Australia

• They are very hot and very dry

• It sometimes only rains every two to three years or when it does rain, it rains a lot

• It was be as hot as 50C in the day and as cool as 5C at night

Adaptions - Cacti

• thick, waxy skin to reduce loss of water and to reflect heat

• large, fleshy stems to store water

• thorns and thin, spiky or glossy leaves to reduce water loss

• spikes protect cacti from animals wishing to use stored water

• deep roots to tap groundwater

• long shallow roots which spread over a wide area
• plants lie dormant for years until rain falls

Adaptions – Camel

• long eye lashes, hairy ears and closing nostrils help to keep out sand

• thick eyebrows which stand out and shade eyes from the sun

• wide feet so they don’t sink in the sand

• they can go without water for over a week because they can drink gallons in one go

• they can go months without food – they store fat in their humps

• body temperature can change to avoid losing water through sweating

• they are well camouflaged

• thick fur helps to keep them warm at night

Precipitation and wind:

What is precipitation?

• Warm air rises and as it moves it takes water vapour with it. As the air rises it cools and the water vapour condenses to form clouds. Eventually the clouds release precipitation in the forms of rain, sleet, snow or hail.

Types of rainfall

• There are 3 main types of rainfall
  
  – Convectional
  
  – Frontal
  
  – Relief
**Convectional rainfall**

- As strong sunshine warms up the ground and the air above it, pockets of warm air rise as convection currents
- At high altitude the air cools and condenses to form clouds
- The rainfall is typically heavy and often as thunderstorms
- Typical around the equator

**Frontal rainfall**

- When warm air meets cool air, this is known as a front
- The warm air rises over the cool air and clouds are formed
- Eventually it rains. This is very common in the UK where cold polar air meets warm tropical air

**Relief rainfall**

- When warm air hits a mountain it is forced to rise
- This leads to cooling and condensation on the side of the mountain
- As the air descends it becomes dry, creating a rain shadow

**What is wind?**

- Wind is the movement of air from areas of high pressure to areas of low pressure

**3 types of wind**

- The main types of wind are
  - Trade winds
— Jet streams
— Katabatic winds

**Trade winds**

- Winds blown from high pressure belts to low pressure belts are known as trade winds
- Historically this is how trade ships sailed around the world!

**Jet streams**

- These are winds high in the atmosphere
- They are very strong as there is little in their way to slow them down
- The strongest jet stream wind was recorded on top of Mt Everest at 225km/h!

**Katabatic winds**

- These are caused by air moving downhill
- In the Antarctic this can lead to winds heading out to sea of up to 320km/h!

**Tropical storms:**

**Key words**

- Tropical storm
- Hurricane
- Typhon
- Cyclone
- Twister
Formation of a tropical storm

1. The sun sends incoming solar radiation to Earth which warms our oceans! This is most intense around the tropics and the equator.

2. This warms the oceans to a critical 27°C, any less does not work.

3. This causes warm moist air to rise through the air in thermals. This gives low pressure at the centre of the storm (pre-empting the eye).

4. This air cools as it rises, at 1°C per 100m; this causes condensation to occur, clouds to form and precipitation (usually rain) to occur.

5. Some cooled air sinks back down helping to create the eye of the storm.

Hurricane formation

- Sun warms the ocean
- Air rushes creating winds
- Ocean temperature must be at least 27°C
- The warm ocean evaporates and rises through the air
- Cumulonimbus clouds
- The storm rotates due to the rotation of the earth
- The air cools as it rises causing condensation
**Drought:**

- When an area has less water than it usually expects it can have huge consequences
- The impact of drought varies greatly from place to place e.g. UK to the Sahel
- In some places they are a hazard and in others they can cause death
- Drought is linked to long periods of high pressure
- This results in few clouds and therefore very little precipitation
- Also linked to high temperatures, there is an increase in the evaporation of ground water e.g. from rivers and lakes
- Drought is often not helped by water waste

**Drought is increasing**

- Global droughts are on the up
• Since 1940 we have seen more and more droughts

• This is thought to be down to changing global rainfall and evaporation patterns as a result of climate change

**Drought in the UK:**

*Hottest ever day*

• 38°C in 2015

*However...*

• In July 2016 the average temperature was just 15 °C

**St Osyth**

• St Osyth in Essex is the driest place in the UK

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**Climate Graph for Saint Osyth, Essex**

- **Temperature (°C)**: 0 to 20
- **Precipitation (mm)**: 0 to 60

- **Temperature** (red line)
- **Precipitation** (blue bars)

- **Months**: January to December
Causes of drought in the UK

- **Less rainfall** – often linked to unusual wind patterns bringing dry winds from the east rather than wet winds from the west

- **Warm temperatures** – increasing evaporation

- **Dry soils** – soils that are baked cannot absorb as much water

- **High water usage** – People in the UK use around 1.7 billion litres of water per day, well above the global average

El Niño and La Niña:

**Definitions**

- **El Niño** is a climate cycle in the Pacific Ocean with a global impact on weather patterns. The cycle begins when warm water in the western tropical Pacific Ocean shifts eastward along the equator toward the coast of South America. Normally, this warm water pools near Indonesia and the Philippines

- **La Niña** is the positive phase of the El Niño Southern Oscillation and is associated with cooler than average sea surface temperatures in the central and eastern tropical Pacific Ocean

El Niño

- Caused by changes in sea temperature in a band across the Pacific ocean

- When the trade winds from east to west are weaker the sea surface temperature increases
La Niña

- La Niña is the opposite of El Niño
- Literally translates as “the girl”
- Typically occurs half as often as El Niño
- Caused by changes in sea temperature in a band across the Pacific ocean
- When the trade winds from east to west are stronger the sea surface temperature decreases

Impacts

- Both events change global rainfall
- In El Niño events we see less rainfall on the Australian/Asian edge of the Pacific
- La Niña reverses this

El Niño and La Niña

- The two events link closely to droughts around the world
- The effects are greatest in the Equator and tropical areas

Consequences

- Food and water shortages
- Bush fires
- Poor air quality
- Power cuts (linked to hydroelectric power)
- However, can increase rainfall in other areas
Plate tectonics:

Key words

- Destructive plate margins – Where two plates are moving towards each other
- Constructive plate margins – Where two plates are moving away from each other
- Conservative plate margins – Where two plates are moving sideways past each other
- Subduction – Where one plate moves under another

Plate margins

- There are three types of plate margin:

Destructive plate margins

- Where oceanic plate meets a continental plate. The denser oceanic plate is forced down into the mantle and destroyed.
- This often creates volcanoes and ocean trenches.
- There are three types of plate margin

Constructive plate margins

- Where two plates are moving away from each other e.g. The mid Atlantic ridge.
  - Magma rises from the mantle to fill the gap, cools and creates new crust.
- There are three types of plate margin
Conservative plate margins

- Where two plates are moving sideways past each other, or are moving in the same direction but at different speeds. E.g. Along the west coast of the USA. Crust is not created or destroyed.

Earthquakes:

What are earthquakes?

- Earthquakes are vibrations caused by earth movements at plate boundaries and at major fault lines (cracks in the earth’s surface).
- They can occur at all four major plate boundaries but the most severe earthquakes are normally found at conservative and destructive plate boundaries.

Conservative plate margin

- Plates try to slide past each other
- Plates are moving in different directions
- Movement is not constant – plates stick together
- A large amount of pressure builds up
- Pressure is suddenly released and the plates move, causing an earthquake
- As land is not being created or destroyed at these margins, there are no volcanoes
**Epicenter and focus**

- The **focus** is the point at which the rock moves.
- **Seismic waves** start at the focus.
- The **epicentre** is directly above the focus on the earth’s surface.
- Earthquakes occur at all plate margins, as well as along fault lines that spread out from the main fault. They are particularly violent at destructive and conservative plate margins.
- Over time, stress builds up at these places. The longer a fault remains locked, the more stress builds up and the greater the chance of it having a major earthquake.
- Plate margins as plates rarely move continually. When this is suddenly overcome the plate moves, causing the rocks to fracture and creating an earthquake.
- The longer a fault remains locked, the more stress builds up and the greater the chance of it having a major earthquake.

**Earthquake waves**

- Earthquakes produce two main waves which travel at different speeds (**body waves** which travel through the Earth and **surface waves**).
- **P-waves** are the fastest and travel through both solids and liquids.
- **S-waves** are slower and can only travel through solids.
- Love waves shake the ground at right angles to the direction of movement; they are faster than Rayleigh waves.
• Rayleigh waves produce both horizontal and vertical ground movement, occurring in a rolling motion. These are what often cause the most damage.

**Earthquake measurement**

• Earthquakes are measured on a seismometer.

• The intensity or size of the earthquake is measured on the Richter scale. This records an earthquake’s magnitude.

• The Richter scale is logarithmic, so a magnitude 7 earthquake is 10 times more powerful than a magnitude 6.

• An earthquake larger than magnitude 5 is likely to cause some structural damage to buildings.

• Earthquake intensity (degree of surface shaking) is measured using a qualitative scale called the Mercalli scale.
Measuring earthquakes – The Richter Scale

• This measures the magnitude of a tremor (how powerful it is) using an instrument called a **seismograph**.

• On the Richter Scale, magnitude is expressed in whole numbers and decimal fractions. Although the Richter Scale has no upper limit, the largest earthquake ever recorded was in 1960 in Chile. It measured **9.5** on the Richter Scale.

• It is a **logarithmic** scale which means that a size ‘6’ on the Richter Scale is 10 times larger than a size ‘5’ and 100 times larger than a size ‘4’.

Measuring earthquakes – The Mercalli Scale

• The **Mercalli scale** measures how much damage is caused by the earthquake based on **observations**.

• It is measured on a scale between 1 and 12.

Disaster response – Haiti:

The facts:

• 12th January 2010 at 16:53 local time, an earthquake measuring 7.0 on the Richter scale struck Haiti.

• The focus was 13km underground

• The epicentre was 25km from the capital Port-au-Prince

• Haiti suffered a huge number of serious aftershocks.
What were the effects of the earthquake?

- Primary effects are the things that happen immediately as a result of an earthquake or other disaster.
- Secondary effects happen in the hours, days and weeks after the initial earthquake.

**Primary effects**

- 220 000 people were killed
- 300 000 people were injured
- 1.3 million Haitians were displaced (homeless).
- Eight hospitals or health care centres in Port-au-Prince were badly damaged or collapsed.
- 200 000 homes were damaged in the Port-au-Prince area.
- The main shipping port was badly damaged and part of it collapsed into the sea.
- 100 000 homes were destroyed.
- Many Government buildings including the Presidential Palace were destroyed.
- Roads were blocked by fallen buildings and smashed vehicles.

**Secondary effects**

- Over 2 million Haitians were left without food and water.
- Looting became a serious problem.
- The destruction of the Government buildings hindered the government’s efforts to control Haiti and the police force collapsed.
- The Haitian tourist industry declined as tourists stopped visiting.
- The damage to the Port and main roads meant that critical aid supplies for immediate help and long-term reconstruction were prevented from arriving or being distributed effectively.
• By November 2010 there were outbreaks of cholera.

• The many dead bodies in the streets and under rubble, created a health hazard in the heat. So many had to be buried in mass graves.

• Displaced people were moved into tents and temporary shelters.

• There were frequent power cuts.

**Disaster response – New Zealand:**

• New Zealand is at risk from both earthquakes AND volcanoes because of the plate boundary it is on.

**Living with earthquakes**

• In New Zealand there is an Earthquake Commission which everyone contributes to as part of their insurance cover. This fund stands at billions of dollars.

• There is a strict building code which is reviewed every 10 years and is enforced for all new buildings. Recommendations are made to people with older buildings.

• With most people living in urban areas, it means that the government can make sure that infrastructure is up to the highest standard and emergency services can be fully organised in case of a disaster.

• Education is an important part of living in a tectonic area and everyone knows what to do in an earthquake, a tsunami or when a volcano erupts.

• Community is very important, and after an earthquake everyone works together.

**Management to reduce risk:**

*Why would people live in earthquake-prone areas?*

• They may have no/limited choice
• At collision plate boundaries, hills and mountains are created, this attracts tourists, and is nice scenery.

• Fertile soil - new soil is produced, richer in minerals and nutrients and plants grow better there

• For example, Japan is very prone to earthquakes. However, people still want to live there as it is a wealthy country. And good jobs can be found there. Economic interests is one of the consideration for people when choosing places to live.

_How to prepare the house for an earthquake_

• Secure heavy appliances to studs in the wall so that they are less likely to move

• Take all heavy objects of shelves, to prevent things from falling on your head

• Put latches on cupboards to prevent doors from swinging open

• Make sure all pictures, clocks, e.t.c hanging on the wall are securely screwed in, so there is no chance of them falling

• Have safety film put over your windows, glass can break easily in a severe earthquake

• Make sure all flammable liquids are placed on the lowest shelves of cupboards, or in a garage or garden shed.

_What to do in an earthquake scenario_

• Move away from windows

• Arrange a meeting point with family

• Protect your head
• Turn off electricity

• Check for fires

• Hang onto door frame

• Keep away from power cables

• Keep away from trees

• Stop driving

• Get outside if possible

• Turn off gas

• Listen to the radio

Supplies you will need:

• Food

• Water

• Medical supplies

• General supplies: batteries, portable radio, etc.