Year 9 Geography Distance Learning Quiz and Learn Booklet

Name:

Form:
Hello Year 9 Geographers!

Over the next 6 weeks, you will be completing work based on knowledge that we have covered in lessons.

This booklet is designed to give you practice with core units, which will form part of the GCSE content, should you be selecting Geography as one of your GCSE options! This will ensure that you are beginning Y10 in the best position possible.

This booklet comprises of 6 lessons:
1. w/c 1st June
2. w/c 8th June
3. w/c 15th June
4. w/c 22nd June
5. w/c 29th June
6. w/c 6th July

There is a quiz to complete at the end of each lesson, and there are also additional practice questions for you to complete after the 6 weeks (at the end of the booklet.)

Ensure you complete the quizzes without looking at your lesson, so that you can check that you have understood the content. Please also feel free to use your Knowledge Organisers and Self-quizzing packs to support your work.

If you have any questions, please do not hesitate contact your teacher.

Good luck!

Ms Coton and Mr Jennings

lcoton@arkkingsacademy.org  j.jennings@arkkingsacademy.org

**Week 1 – Natural Hazards**
The two main types of natural hazards are tectonic and climatic. Natural hazards can have economic, social and environmental consequences. The risks of these occurring can vary greatly.

**What is a natural hazard?**

Natural hazards are extreme natural events that can cause loss of life, extreme damage to property and disrupt human activities.

Some natural hazards, such as flooding, can happen anywhere in the world. Other natural hazards, such as tornadoes, can only happen in specific areas. And some hazards need climatic or tectonic conditions to occur, for example tropical storms or volcanic eruptions.

Human activities can influence how often certain natural hazards occur and how severe they are. Understanding when, where, why and how natural hazards occur can help us to understand how to minimise their impact on our lives.

**Types of natural hazard**

Natural hazards can be placed into two categories - **tectonic hazards** and **climatic hazards**.

Tectonic hazards occur when the Earth's crust moves. For example, when the plates move, friction can cause them to become stuck. Tension builds until the plates release, which leads to an earthquake.

Climatic hazards occur when a region has certain weather conditions, for example heavy rainfall can lead to flooding.
<table>
<thead>
<tr>
<th>Tectonic hazards</th>
<th>Climatic hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earthquakes</td>
<td>Flooding</td>
</tr>
<tr>
<td>Tsunamis</td>
<td>Tornadoes</td>
</tr>
<tr>
<td>Volcanoes</td>
<td>Tropical storms (hurricanes)</td>
</tr>
<tr>
<td>Mountain avalanches</td>
<td>Droughts</td>
</tr>
</tbody>
</table>

**Hazard risks - economic, social and environmental consequences**

Hazards can have economic, social and environmental consequences. For each hazard event the risks, or probability, of a particular consequence occurring can vary greatly.

This depends on certain factors. For example in a developing country, the death toll tends to be high but the short-term economic costs are often relatively low, whereas in a developed country, the death toll tends to be low but the short-term economic costs can be extremely high.

The long-term situation is more complex. Developing countries can be slower to repair damage to roads and buildings. This can lead to a reduction in tourists and therefore a long-term loss of valuable income.

Hazard risks are increasing due to population growth, urbanisation, pressure on marginal land and changes to the natural environment.
Earthquakes and volcanic eruptions affect people all over the world. They are caused by the movement of tectonic plates. Tectonic hazards can destroy buildings, infrastructure and cause deaths.

The Earth's structure and plate tectonics

The Earth is made up of different layers:

1. **The inner core** is in the centre and is the hottest part of the Earth. It is solid and made up of iron and nickel with temperatures of up to 5,500°C.

2. **The outer core** is the layer surrounding the inner core. It is a liquid layer, also made up of iron and nickel.

3. **The mantle** is the thickest section of the Earth at approximately 2,900 km. The mantle is made up of semi-molten rock called magma.

The theory of plate tectonics

The **crust** is the outer layer of the Earth. It is a thin layer between 0 - 60 km thick. The crust is the solid rock layer upon which we live. It is
either continental or oceanic. The earth’s crust is broken into plates. Heat rising and falling inside the mantle creates convection currents generated by radioactive decay in the core. The convection currents move the plates. Where convection currents diverge near the Earth’s crust, plates move apart.

Where convection currents converge, plates move towards each other. The movement of the plates, and the activity inside the Earth, is called the theory of plate tectonics.

Global distribution of earthquakes and volcanoes

The earth’s surface is made up of two types of crust:

- Oceanic crust - found underneath the oceans. It is denser than continental crust and can be subducted.
- Continental crust - found under land masses or continents. It is generally older than oceanic crust and is less often destroyed.

Earthquakes are found along all types of plate margins as shown on this map. Volcanoes however, only occur at constructive and destructive plate margins.

A lot of volcanic activity occurs in the 'ring of fire'. The 'ring of fire' is a group of volcanoes that are located along the plate margin of the Pacific plate.
Destructive, constructive and conservative plate margins

Destructive plate margins

A destructive plate margin usually involves an oceanic plate and a continental plate. The plates move towards one another and this movement can cause earthquakes.
As the plates collide, the oceanic plate is forced beneath the continental plate. This is known as subduction. This happens because the oceanic plate is denser (heavier) than the continental plate.

When the plate sinks into the mantle it melts to form magma. The pressure of the magma builds up beneath the Earth's surface. The magma escapes through weaknesses in the rock and rises up through a composite volcano. The volcanic eruptions are often violent, with lots of steam, gas and ash.

If two continental plates collide, neither can sink and so the land buckles upwards to form fold mountains. This is called a collision margin. Earthquakes can occur at collision margins.

**Constructive plate margins**

At a constructive plate margin the plates move apart from one another. When this happens the magma from the mantle rises up to make (or construct) new land in the form of a shield volcano. The movement of the plates over the mantle can cause earthquakes.
Conservative plate margins

At a conservative plate margin, the plates move past each other or are side by side moving at different speeds. As the plates move, friction occurs and plates become stuck. Pressure builds up because the plates are still trying to move. When the pressure is released, it sends out huge amounts of energy, causing an earthquake. The earthquakes at a conservative plate boundary can be very destructive as they occur close to the Earth's surface. There are no volcanoes at a conservative plate margin.
Earthquakes
Earthquakes are caused by the release of built-up pressure at plate margins. They can destroy buildings and infrastructure, with devastating and deadly effects.

Causes of earthquakes

What causes earthquakes?

Earthquakes are the sudden violent shaking of the ground. This happens because the Earth's plates are constantly moving. Sometimes, because of friction, plates try to move and become stuck. Pressure builds up because the plates are still trying to move. When the pressure is released, it sends out huge amounts of energy causing the Earth's surface to shake violently.

The point inside the Earth's crust where the earthquake originates from is known as the **focus**. The earthquake's energy is released in seismic waves and they spread out from the focus. The **seismic waves** are most powerful at the epicentre. The epicentre is the point on the Earth's surface directly above the focus.

Earthquakes are found at all three plate boundaries: constructive, destructive and conservative plate boundaries.
Measuring earthquakes

A Willmore seismometer measures earthquakes

Earthquakes, until recently, have been measured on the Richter scale. The Richter scale measures the magnitude of an earthquake (how powerful it is). It is measured using a machine called a seismometer which produces a seismograph. A Richter scale is normally numbered 1-10, though there is no upper limit. It is logarithmic which means, for example, that an earthquake measuring magnitude 5 is ten times more powerful than an earthquake measuring 4. Earthquakes measuring 1-2 on the scale happen regularly, and they are so small that people cannot feel them. Earthquakes measuring upwards of 7 are less frequent but very powerful, and can cause a lot of destruction.

The largest earthquake ever recorded was in Chile in 1960, which measured 9.5 on the Richter scale. The Richter scale is not very accurate in measuring these larger earthquakes and today scientists use the Moment Magnitude Scale which uses the same logarithmic scale but which more accurately measures the strength of larger earthquakes.

Different magnitudes of earthquake on the Richter scale
Effects and responses of earthquakes

Effects

The effect of an earthquake is the damage which happens as a result of the earthquake. The effects of an earthquake can vary depending on:

- The size of the earthquake on the Richter scale - the higher it is on the scale, the more destruction it can cause.
- Level of development - whether it occurs in a rich or a poor country. Richer countries will be more likely to be able to predict, protect and prepare themselves from the effects of an earthquake.
- The depth of the focus - if it's shallow, it can be more destructive.
- Distance from epicentre - the effects of an earthquake are more severe at its centre.
• Population density - the more people living in an area, the more likely that more deaths and casualties may arise.

• The time of day - whether people are in their homes, work or travelling.

We can classify the effects of an earthquake into the following categories:

• primary effects - things that happen immediately as a result of an earthquake

• secondary effects - things that happen in the hours, days and weeks after the initial earthquake

Responses

Responses are how countries react to an earthquake. They are categorised as follows:

• **Short-term or immediate** - a response in the days and weeks immediately after a disaster has happened. Short-term responses mainly involve search and rescue and helping the injured.

• **Long-term** - responses that go on for months and years after a disaster. It involves rebuilding destroyed houses, schools, hospitals, etc. It also involves kick-starting the local economy.

Case study high income country (HIC) - Christchurch 2011

Causes

An earthquake-damaged home stands at the edge of a cliff in Christchurch

The earthquake struck on 22 February 2011. It was a 6.3 magnitude earthquake and the focus was very shallow at 4.99 km deep. The earthquake happened on a conservative plate margin between the Pacific Plate and the Australian Plate.
Effects

Primary

- 181 people were killed.
- 2,000 injured.
- Over 50 per cent of the city's buildings were damaged.
- The city's cathedral spire collapsed.
- Water and sewage pipes were damaged.

Secondary

- Businesses were closed for a long time.
- Christchurch couldn't hold the five Rugby World Cup matches.
- Schools were closed for two weeks due to the damage.

Responses

Short-term

- International aid was provided (around $6-7 million).
- Aid workers from charities such as the Red Cross came to help.
- Areas were zoned to assess damage.
- 300 Australian police officers were flown in.

Long-term

- $898 million in building insurance claims.
- Water and sewerage were restored to the city by August 2011.
- Temporary housing was provided.
Case study low income country (LIC) - Haiti 2010

Causes

Port-au-Prince, Haiti

On 12 January 2010, a 7.0 earthquake struck Haiti. The earthquake occurred on a destructive plate margin between the Caribbean and North American plates. The focus was only 12.87 km deep and the epicentre was just 25.75 km from the capital, Port-au-Prince.

Effects

Primary

- 220,000 people were killed.
- 300,000 people were injured.
- The main port was badly damaged.
- Eight hospitals collapsed.
- 100,000 houses were destroyed and 200,000 were damaged.
- 1.3 million people became homeless.

Secondary

- 2 million people were left without food and water.
- Frequent power cuts occurred.
- Crime increased - looting became a problem and sexual violence escalated.
- People moved into temporary shelters.
- By November 2010 there were outbreaks of cholera.
Responses

Short-term

- Crucial aid was slow to arrive due to the damaged port.
- USA sent rescue teams and 10,000 troops.
- Bottled water and purification tablets were provided.
- 235,000 people were moved to less-damaged cities away from Port-au-Prince.
- The UK government donated £20 million.

Long-term

- Haiti was dependent on overseas aid.
- New homes were built to a higher standard although the response was slow. One year after the earthquake, over one million people were still living in temporary shelters.
- The port needed rebuilding which required a large amount of investment.
Prediction, protection and preparation

Prediction

Prediction involves using seismometers to monitor earth tremors. Experts know where earthquakes are likely to happen. However, it is very difficult to predict when they will happen. Even looking at the timescale between earthquakes doesn't seem to work.

Protection

Protection involves constructing buildings so that they are safe to live in and will not collapse. Some examples of building improvements are:

- rubber shock absorbers in the foundations to absorb the Earth tremors
- steel frames that can sway during Earth movements
- open areas outside of the buildings where people can assemble during an evacuation

Preparation

In earthquake-prone countries, hospitals, emergency services and residents practise for an earthquake. They have drills in all public buildings so that people know what to do in the event of an earthquake. This helps to reduce the impact and increases their chance of survival.

Example of an earthquake-proof building
Volcanoes
Composite and shield volcanoes are found along plate margins. They have distinctive characteristics and can have both positive and negative effects on people and the landscape.

Volcano locations

Volcanoes form when magma, which is molten rock from beneath the Earth’s crust, reaches the surface. The magma erupts to form lava.

Volcanoes usually form along plate margins, where crustal plates are either moving towards or away from one another:

- Constructive margin - this is where two plates move away from one another. Magma rises up to fill the gaps in between.
- Destructive margin - this is where two plates move towards one another. The oceanic crust sinks beneath continental crust at a subduction zone - a point where one crustal plate is forced beneath another. As the oceanic crust sinks into the mantle it creates magma, which rises to form a volcano.

Volcanoes affect different places in different ways. They cause more damage in poorer countries, where there are fewer resources to predict and prepare for them.

Mount Aso in Japan is one of the world's most active volcanoes.

Mount Aso in Japan is one of the world's most active volcanoes.
Structure and common features of volcanoes

Volcanoes have distinctive features:

- magma chamber - this is where the molten rock is stored beneath the ground
- main vent - this is the channel through which magma travels to reach the Earth's surface
- secondary vent - some magma may escape through the side of the volcano, particularly if the main vent becomes blocked
- crater - this is found at the top of the volcano, where the magma erupts from

The positive and negative effects of volcano eruptions

Volcanoes have a large effect on their locality. They produce ash, lava, volcanic bombs, pyroclastic flows and lahars. Ash from large volcanoes has been known to affect global climates.

The effects of volcanoes can be both positive and negative.
Positive effects

- Geothermal energy is where heat from within the Earth is used to generate electricity. Geothermal energy can be generated in areas where magma lies close to the surface. This is good for increasing our renewable energy use.
- Ash ejected by the volcano acts as a good fertiliser for soils.
- Volcanoes attract many tourists, who enjoy the dramatic scenery that they produce.

Negative effects

- Volcanoes are dangerous. They can kill people and damage property.
- Economic activity can suffer as it is hard for businesses to operate after an eruption.
- Habitats and landscapes are damaged by lava flows.
Types of volcano - composite and shield

There are two main types of volcano - **composite** and **shield**. The two types of volcano form in different places and have very different characteristics.

**Composite volcanoes**

Composite volcanoes are found on destructive plate margins, where the oceanic crust sinks beneath the continental crust. Composite volcanoes have the following characteristics:

- **Acidic lava**, which is very viscous (sticky).
- Steep sides as the lava doesn't flow very far before it solidifies.
- Alternate layers of ash and lava. For this reason, they're also known as stratovolcanoes. Strato means layers.
- Violent eruptions.
- Longer periods between eruptions.
An example of a composite volcano is Mount Pinatubo in the Philippines.

**Shield volcanoes**

Shield volcanoes are found on constructive plate margins, where two plates move away from one another. Shield volcanoes have the following characteristics:

- **basic lava**, which is non-acidic and very runny
- gentle sides as the lava flows for long distances before it solidifies
- no layers, as the volcano just consists of lava
- less violent eruptions
- shorter periods between eruptions
Mauna Loa is a shield volcano, but was formed over a hot spot, rather than at a constructive plate margin, like other volcanoes.

Monitoring volcanoes - popular techniques

Volcanic eruptions are unpredictable. However, scientists can monitor volcanoes to estimate when they are likely to erupt. Scientists can use a variety of techniques to do this, such as:

- seismometers - used to measure earthquakes occurring near an eruption
- tiltmeters and GPS satellites – these devices monitor any changes in landscape. Volcanoes tend to swell near an eruption
• monitoring gases escaping from a volcano using robots called Spiders – often there is an increased release of sulphur dioxide near an eruption
• measuring temperature - volcanoes become hotter when magma starts to rise through the main vent
• looking at the past history of eruptions - scientists can identify patterns of activity

Benefits of living by a volcano

A man works in a field with Mount Mayon in the distance.

People choose to live in volcanic areas despite the risks of an eruption. Volcanoes can provide people with many benefits such as:

• volcanic rock and ash provide **fertile land** which results in a higher crop yield for farmers
• **tourists** are attracted to the volcano, which increases money to the local economy
• geothermal energy can be harnessed, which provides cheaper electricity for locals
• minerals are contained in lava, eg diamonds - these can be mined to make money
Week 5 – Tropical Storms

Tropical storms are immensely powerful and can travel up to speeds of 65 km/h. Resembling large whirlpools, they are made up of rotating, moist air, with wind speeds that can reach over 120 km/hr.

Global atmospheric circulation

The movement of air across the planet occurs in a specific pattern. The whole system is driven by the equator, which is the hottest part of the Earth. Air rises at the equator, leading to low pressure and rainfall.

When the air reaches the edge of the atmosphere, it cannot go any further and so it travels to the north and south. The air becomes cold and falls to create high pressure and dry conditions at around 30° north and south of the equator. Large cells of air are created in this way. Air rises again at around 60° north and south and descends again around 90° north and south.

Global atmospheric circulation creates winds across the planet and leads to areas of high rainfall, like the tropical rainforests, and areas of dry air, like deserts.
What is a tropical storm?

A tropical storm is a very powerful low-pressure weather system which results in strong winds (over 120 km/h) and heavy rainfall (up to 250 mm in one day). Tropical storms have different names depending on where they occur in the world. In the US and the Caribbean they are known as hurricanes, in South Asia - cyclones, in East Asia - typhoons and in Australia they are known as willy-willies. They all develop in the same way and have the same characteristics.

Structure, features and the development of tropical storms

In appearance, a tropical storm is like a huge whirlpool - a gigantic mass of revolving moist air.

Tropical storms are between 482-644 kilometres wide and 6-8 kilometres high. They move forward at speeds of 16-24 km/h, but can travel as fast as 65 km/h. The Coriolis force caused by the rotation of the Earth causes the tropical storm to spin.
The central part of the tropical storm is known as the **eye**. The eye is usually 32-48 km across. It is an area of light wind speeds and no rain. It contains descending air.

Large towering cumulonimbus clouds surround the eye. These are caused by warm moist air condensing as it rises. This leads to very heavy rainfall and wind speeds of up to 320 km/h.

**How tropical storms develop**

- Tropical storms form between approximately 5° and 30° latitude. Because of easterly winds they initially move westward.
- The air above the warm ocean is heated. Once the ocean water reaches at least 27°C, the warm air rises quickly, causing an area of very low pressure.
- As the air continues to rise quickly it draws more warm moist air up from above the ocean leading to strong winds.
- The rapidly rising warm air spirals upwards, cools, condenses and large cumulonimbus clouds form.
- These clouds form the eye wall of the storm and produce heavy rainfall.
- In the centre of the storm, cold air sinks forming the eye of the storm - here, conditions are calm and dry.
When tropical storms reach a land surface, they begin to lose their energy and die out. This is because they are no longer receiving heat energy and moisture from the ocean, which is needed to drive the storm.

The impacts of climate change on tropical storms

Climate change could lead to more locations being affected by tropical storms. Warmer seas could cause the source areas (the areas where the storms would form) to extend further north and south of the equator.

It's unclear whether climate change will increase or decrease the number of hurricanes, but climate models predict that their intensity may increase. The following factors may play a part in increasing their impact:

- warmer ocean surface temperatures and higher sea levels
- wind speeds potentially increasing 2-11 per cent
- rainfall rates during these storms are projected to increase by about 20 per cent

In addition, sea level rise is likely to make tropical storms more damaging with increases in coastal flooding and subsequent storm damage along coasts. Low-lying coastal communities where the population density is high and the income level low are most at risk. More people living in coastal communities in the future will mean that more people will be affected.

Predicting tropical storms - forecasting centres

There are several specialist tropical storm forecasting centres around the world such as the National Hurricane Centre in Miami, Florida.

The centre uses satellite images, various weather instruments and computer-based prediction modelling to detect and track tropical storms. When tropical storms affecting populated coastal areas are predicted, the centre issues warnings.

Warnings give information to the local authorities of places likely to be in the tropical storm's path, in order to make preparations to protect public safety. These are broadcast over TV and radio and warnings can be issued to smart phones. People in vulnerable coastal areas are usually advised to secure their property and move away. In the USA, this can involve the mass evacuation of a million or more people.

Reinforced aircraft, fitted with various scientific instruments, fly through and over tropical storms to collect data. This can be used to help track and predict the path of a tropical storm.
Tropical storm case study - Typhoon Haiyan

Typhoon Haiyan was a tropical storm that affected the Philippines in South East Asia in November 2013. It was one of the strongest tropical storms ever recorded with winds of 313 km/h. In some areas, 281.9 mm of rainfall was recorded, much of which fell in under 12 hours. Waves of up to 7 m in height battered the coast. The Philippines is a fairly poor part of the world with minimal investment in prediction, planning and protection schemes.
Typhoon Haiyan caused significant economic, social and environmental impacts.

**Impacts**

**Economic**

- The overall economic impact of Typhoon Haiyan is estimated at $5.8 billion (£3.83 billion).
- Six million workers lost their sources of income.
- Major rice, corn and sugar-producing areas for the Philippines were destroyed affecting the country's international trade and farmers' incomes.
- The city of Tacloban's airport was severely damaged, affecting business and tourism.
- Fishing communities were severely affected with the storm destroying 30,000 boats and associated equipment.

**Social**

- More than 7,000 people were killed by Typhoon Haiyan.
- 1.9 million people were left homeless and more than 6,000,000 displaced.
- There were outbreaks of disease due to the lack of sanitation, food, water, shelter, and medication.
- Less affected areas reported that their populations more than doubled after the typhoon with the influx of refugees.

The Tacloban city government was devastated, with only 70 people at work in the immediate days after the disaster compared to 2,500 normally. Many were killed, injured, lost family or were simply too traumatised to work.

In the city of Tacloban, widespread looting took place in the days following the typhoon.

**Environmental**

- Widespread floods damaged and in many cases destroyed homes and businesses in coastal areas.
- The Philippine government estimated that about 71,000 hectares of farmland was affected.
- Thousands of trees were uprooted leading to a massive release of carbon dioxide and loss of habitat with resulting effects on wildlife.
- Flooding knocked over Power Barge 103 causing an oil spill affecting mangrove ecosystems.
- Major roads were blocked by trees, and were impassable.
Responses

Even though the loss of life was significant, it could have been much worse if not for the efforts of PAGASA, the Philippines' meteorological agency. It broadcast warnings two days before Typhoon Haiyan hit, leading to the evacuation of approximately 750,000 residents.

The Philippines formally declared 'A State of National Calamity' and asked for international help, one day after Typhoon Haiyan hit the country.

The UK government provided food, shelter, clean water, medicine and other supplies for up to 800,000 victims.

Several charities provided emergency aid such as water, food and shelter. In the longer term, they are helping people get their livelihoods back, for example by repairing fishing boats or distributing rice seeds.

The United Nations launched an international aid appeal in December 2013 for £480m to finance the humanitarian relief effort for 2014.

In 2014, the Philippines commissioned billboards in some of the world's prime advertising sites such as New York's Times Square and London's Piccadilly Circus to thank people for their help after Typhoon Haiyan.
Tropical storm case study - Hurricane Sandy

Hurricane Sandy, a tropical storm occurring in October 2012, started life off the coast of West Africa. It travelled north-west across the Atlantic Ocean through countries such as Cuba, Haiti and The Bahamas in the Caribbean before hitting the east coast of the USA. It led to a wide range of impacts.

**Impacts**

**Economic**

- Hurricane Sandy was the second most costly hurricane on record, causing $71 billion in damages. In New York City, economic losses are estimated at exceeding $18 billion.
- Buildings, cars, people's possessions and business stock were lost.
- More than 18,000 flights were cancelled leading to disruptions in business, tourism and trade.
- Crops were lost resulting in loss of earnings for farmers.

**Social**

At least 286 people were killed either directly or indirectly by Hurricane Sandy. There were 147 direct deaths: 72 in the USA and the rest mainly in the Caribbean, including 54 in Haiti and 11 in Cuba.
Power failure at New York University Langone Medical Centre led to the evacuation of all 215 patients to other hospitals. People were highly stressed and anxious. In the longer term, many people could be affected psychologically by the loss of family and friends.

More than 8.5 million homes and businesses were left without power. In Washington DC and other cities, many supermarkets ran out of essentials such as bottled water and batteries as people prepared for the worst. The New York City marathon was cancelled resulting in a loss of income for many businesses.

**Environmental impacts**

- 346,000 houses were damaged or destroyed in New Jersey and 305,000 damaged or destroyed in New York.
- Makeshift shanty towns in Haiti were washed away.
- Fallen trees and flooded vegetation affected animals’ habitats.
- In areas such as New York and New Jersey, untreated sewage was washed into public drinking water, threatening human health.
- More than 70 per cent of crops, including bananas and maize, were destroyed in the south of Haiti.
- Roads, train lines and other transport infrastructure became unusable due to flooding, resulting in disruptions to travel and trade.
- Approximately 10 metres of beach was lost in some parts of New Jersey, (making it narrower) exposing the coast to further erosion and impacting wildlife.

Cars sit submerged in water on a flooded street in Hoboken, New Jersey

**Responses**

The responses to Hurricane Sandy were very varied. In poorer countries like Haiti there was insufficient prediction, planning or protection and at the time the country was still trying to recover from an earthquake in 2010. This tropical storm set the country back further in terms of its development.
In contrast to this, the USA, a richer country, invested more in tropical storm prediction, planning and protection. By using satellite images and other weather instruments, the National Hurricane Centre in Miami predicted and monitored the path of Hurricane Sandy. The Centre was able to issue warnings to the local authorities and general public and this helped reduce the impact of Hurricane Sandy.

Steps taken to minimise damage

- the President of the USA, Barack Obama, and the authorities appealed to people to stay calm and out of harm's way
- the police evacuated hundreds of thousands of people from low-lying coastal areas most vulnerable to Hurricane Sandy
- schools and public transport services closed down and many flights were cancelled
- people temporarily relocated to evacuation centres such as schools and community centres

In the long term, governments will need to develop strategic plans to prepare for tropical storms. Investments made in flood prevention and coastal protection schemes such as sea walls will be essential. Careful consideration needs to be given to the use of land particularly in low-lying areas. Local people and emergency service teams will need training in how to respond to tropical storm events, ensuring a coordinated and planned response. This should reduce the impact of tropical storms on people and the environment.

Hurricane Sandy aid workers unload supplies
Causes of UK weather

Two different pressure systems bring different types of weather to the UK. They are depressions and anticyclones.

Depressions

A depression is an area that has low atmospheric pressure. Air rising causes the formation of clouds, which brings rainfall. Depressions often move eastwards across the UK, bringing changeable weather as they travel.

There are usually frontal systems associated with depressions. The diagram below shows the changing weather that the warm and cold fronts bring as they move towards the east.

Anticyclones

Anticyclones are areas of high pressure which form when cool air sinks. Anticyclones spin around in a clockwise direction. Anticyclones make skies clear and cause different weather in summer and winter. In summer, anticyclones bring hot, sunny weather. During winter, anticyclones cause cold weather including fog and frost.
Different types of rainfall in the UK

On average, it rains one in three days in the UK. Highland areas to the west receive the most annual rainfall compared to the low-lying areas in the east. The southwest prevailing winds bring moisture from the Atlantic Ocean.

Types of rainfall

There are three different types of rainfall:

- relief
- convectional
- frontal
Relief rainfall

1. Relief rainfall occurs when warm, moist air from the Atlantic Ocean rises up over mountains.
2. When the warm air rises, it cools and condenses to form clouds, which brings rain.
3. Once the air has passed over the mountains, it descends and warms.
4. This creates drier conditions known as a rain shadow.
1. Convectional rainfall usually occurs during the summer in the UK, when the sun heats the land.
2. This creates rising pockets of warm air, known as convection currents.
3. Warm air rises rapidly, where it starts to cool and condenses to form clouds.
4. These clouds can be large cumulonimbus clouds.
5. The clouds can produce heavy rainfall and thunderstorms.

**Frontal rainfall**
1. Frontal rainfall occurs when a warm front meets a cold front. The heavier cold air sinks to the ground and the warm air rises above it.

2. When the warm air rises, it cools.

3. The cooler air condenses and form clouds.

4. The clouds bring heavy rain.

**Extreme UK weather**

The UK's weather is becoming more extreme. Some examples of extreme weather in the UK include:

- heavy rain
- gales
- floods
- heavy snowfall
- thick fog
- heat wave
- drought
Climate change can increase the frequency and intensity of extreme weather events.

Flooding is becoming more frequent in the UK. The Environment Agency is responsible for monitoring the potential for flooding. They evaluate the risk of flooding and issue warnings for areas. They use three codes to help people be able to prepare:

- Flood alert – Flooding is possible. Be alert.
- Flood warning – Flooding is expected. Immediate action required.
- Severe flood warning – Severe flooding. Danger to life.
Case study - the Cumbrian floods 2009

In November 2009, over 31 cm of rain fell in a 24-hour period. This is a record amount of daily rainfall for the UK. This led to the flooding of the town of Cockermouth.

Causes

The warm air from the mid-Atlantic caused relief rainfall over the Cumbrian Mountains. The warmer the air, the more moisture it holds.

1. Warm air from the mid-Atlantic moved towards land due to the prevailing wind.
2. The warm air was forced upwards by the Cumbrian Mountains.
3. As the air cooled, it condensed to form heavy rain. The weather front stopped over Cumbria.
4. The falling rain poured into the River Derwent and River Cocker.
5. Cockermouth is located at the rivers' confluence and as a result, suffered significant flooding.

Impacts

Social

• 1,300 homes were flooded.
• People were evacuated, 50 by helicopter.
• One man died.
Economic

- 3,057 businesses were affected.
- The cost of damage to each household was on average £28,000.
- Insurance claims from the flood were £100 million.

Environmental

- Rivers were significantly altered with increased rates of erosion.
- Four bridges were destroyed and 25 were closed for over six weeks due to the damage. This caused traffic problems in the town.

Reducing the risks

A flood prevention scheme has been implemented which includes a variety of river management schemes. River dredging was used to increase the capacity of the river channel so it could hold more water in the future.

Alerting people to the risk of potential flooding enables the public to evacuate the area, reducing injuries and deaths. Economic losses can also be reduced as people and businesses can move their valuables to a safer area.
### Week 1 Quiz – Natural Hazards

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
</table>
| **What is a climatic hazard?**                                            | A hazard that occurs when the Earth’s crust moves  
A hazard that occurs when a region has certain weather conditions  
A climate that occurs when the climate becomes too hot and causes a drought |
| **What is a tectonic hazard?**                                           | A hazard that occurs when the Earth’s crust moves  
A hazard that occurs when a region has certain weather conditions  
A hazard that is caused by human activities |
| **What would the likely short-term impacts of a climatic hazard be on a developing country?** | A high death toll and high economic cost  
A low death toll and high economic cost  
A high death toll and low economic cost |
| **What factor can influence the impacts of the hazard?**                 | Human activities  
The convection currents of the Earth’s mantle  
Atmospheric conditions |
| **Which hazard can only occur in specific areas?**                      | Flooding  
Droughts  
Tornadoes |
### Week 2 Quiz – Plate Margins

<table>
<thead>
<tr>
<th>Question</th>
<th>Correct Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Which part of the Earth is found above the mantle?</td>
<td>Crust</td>
</tr>
<tr>
<td>What is the name given to semi-molten rock?</td>
<td>Magma</td>
</tr>
<tr>
<td>What is the name given to the hot underground currents which move plates around?</td>
<td>Convection</td>
</tr>
<tr>
<td>What is the name given to margins where plates move together?</td>
<td>Destructive</td>
</tr>
<tr>
<td>What is the name given to margins where plates move apart?</td>
<td>Constructive</td>
</tr>
<tr>
<td>Question</td>
<td>Options</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td>What name is given to margins where plates move side by side?</td>
<td>Convection, Construction, Conservative</td>
</tr>
<tr>
<td>Which islands are found above hot spots?</td>
<td>Hawaii, British Isles, Falklands</td>
</tr>
<tr>
<td>Where do volcanoes occur?</td>
<td>At conservative plate margins, At constructive and destructive plate margins, Along all kinds of plate margins</td>
</tr>
<tr>
<td>What is subduction?</td>
<td>When two plates move towards each other, When two plates move apart from each other, When the oceanic plate is forced beneath the continental plate</td>
</tr>
<tr>
<td>Where is continental crust found?</td>
<td>At the Earth's core, Under land masses and continents, Under oceans</td>
</tr>
</tbody>
</table>
**Week 3 Quiz – Earthquakes**

1. **What is an earthquake?**
   - The sudden and brief period of intense ground shaking
   - Where magma is erupted from the earth
   - The movement of earth’s plates creating new land

2. **At which plate margins do you find earthquakes?**
   - Conservative and destructive
   - Constructive and destructive
   - All three plate margins

3. **What is the point in the Earth's crust where the earthquake originates known as?**
   - Epicentre
   - Focus
   - Shock waves

4. **What is the point on the Earth's surface directly above where the earthquake originates?**
   - Epicentre
   - Focus
   - Shock waves

5. **What piece of equipment measures earthquakes?**
   - Seismometer
   - Richter Scale
   - Mercalli Scale
### What is an example of a primary effect?
- Aid from other countries
- Rebuilding houses
- Deaths and injury

### What is an example of a short-term response?
- Water and powerlines are disrupted
- Aid from other countries
- New homes are built to cope with earthquakes

### What is earthquake prediction?
- Constructing buildings so they are safe
- Attempts to forecast an earthquake
- Organising activities so people know what to do in an earthquake

### How can buildings be adapted to cope with earthquakes?
- Rubber shock absorbers fitted to absorb earth tremors
- Using glass as the main material for the building
- Building all buildings close together

### How do people prepare for earthquakes?
- They can watch the TV to see the earthquake forecast
- They can't do anything; people just hope they don't happen
- Have drills and educate people on what to do in the event of an earthquake
### Week 4 Quiz – Volcanoes

<table>
<thead>
<tr>
<th></th>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Where are volcanoes found?</td>
<td>- Along constructive and destructive margins</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Along constructive and conservative margins</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Along destructive and conservative margins</td>
</tr>
<tr>
<td>2</td>
<td>Where do volcanoes cause the most damage?</td>
<td>- In richer countries</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- In poorer countries</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- In lower latitudes</td>
</tr>
<tr>
<td>3</td>
<td>Where is the crater found?</td>
<td>- At the top of the volcano</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Beneath the ground</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- On the side of the volcano</td>
</tr>
<tr>
<td>4</td>
<td>Which part of a volcano can have a global impact?</td>
<td>- Lahars</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Pyroclastic flows</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Ash</td>
</tr>
<tr>
<td>5</td>
<td>Which of the following is a positive effect of a volcano?</td>
<td>- Damaged buildings</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Habitat loss</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Tourism</td>
</tr>
</tbody>
</table>
**Which of the following is a negative effect of a volcano?**
- Damaged buildings
- Geothermal energy
- Tourism

**Which of the following is a characteristic of a composite volcano?**
- Gentle sides
- Layers of ash and lava
- Basic lava

**Which of the following is a characteristic of a shield volcano?**
- Acidic lava
- Erupts less frequently
- Found along constructive margins

**Which of the following volcanoes is a shield volcano?**
- Yellowstone, USA
- Mount Pinatubo, Philippines
- Mauna Loa, Hawaii

**Which is an instrument that helps to monitor volcanoes?**
- Barometer
- Tiltmeter
- Richter scale
### Week 5 Quiz – Tropical Storms

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. What type of pressure system is a tropical storm?</strong></td>
<td>High-pressure system, Low-pressure system, Medium-pressure system</td>
</tr>
<tr>
<td><strong>2. What is the central part of the tropical storm known as?</strong></td>
<td>The eye, The core, The hub</td>
</tr>
<tr>
<td><strong>3. What is the name of the tall clouds found at the centre of the tropical storm?</strong></td>
<td>Cirrus, Stratus, Cumulonimbus</td>
</tr>
<tr>
<td><strong>4. Tropical storms form when water is at what minimum temperature?</strong></td>
<td>27°C, 20°C, 25°C</td>
</tr>
<tr>
<td><strong>5. Which of the following is NOT a risk posed to human settlements by hurricanes?</strong></td>
<td>Flooding of coastlines, Earthquakes</td>
</tr>
</tbody>
</table>
### 6. When does a tropical storm begin to lose energy?
- When the tropical storm reaches the equator
- When the tropical storm reaches land
- When the temperature of the water is above 27°C

### 7. How will climate change have an effect on tropical storms?
- Tropical storms will become more frequent
- Tropical storms will become less frequent
- Tropical storms will become more intense/powerful

### 8. Which method can help track and predict tropical storms?
- Tiltmeters
- Seismographs
- Satellite images

### 9. Typhoon Haiyan occurred in which area of the world?
- South East Africa
- South East Asia
- North America

### 10. What is a social impact of Typhoon Haiyan?
- 1.9 million people were left homeless
- 71,000 hectares of farmland was affected
- 6 million workers lost their income
### Week 6 Quiz – Extreme Weather in the UK

1. **What type of weather conditions does a depression bring?**
   - [ ] Unsettled weather with varied rainfall
   - [ ] Settled weather, dry and clear skies
   - [ ] Settled weather, usually constant rainfall

2. **What type of weather conditions does an anticyclone bring to the UK in the summer?**
   - [ ] Unsettled weather with varied rainfall
   - [ ] Settled weather, dry and clear skies
   - [ ] Settled weather, usually constant rainfall

3. **What is relief rainfall?**
   - [ ] When a warm front meets a cold front leading to heavy rainfall
   - [ ] It occurs during the summer in the UK, when the sun heats the land
   - [ ] When warm, moist air from the Atlantic Ocean rises up over mountains

4. **What is frontal rainfall?**
   - [ ] When a warm front meets a cold front leading to heavy rainfall
   - [ ] It occurs during the summer in the UK, when the sun heats the land
   - [ ] When warm moist air from the Atlantic Ocean rises up over mountains

5. **What is convective rainfall?**
   - [ ] When a warm front meets a cold front leading to heavy rainfall
   - [ ] It occurs during the summer in the UK, when the sun heats the land
   - [ ] When warm moist air from the Atlantic Ocean rises up over mountains
<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td><strong>What type of rainfall was the cause of the Cumbrian floods?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Relief rainfall</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Frontal rainfall</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Convectional rainfall</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td><strong>How much rainfall fell in 24 hours which led to the Cumbrian floods?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>21 cm</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>29 cm</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>31 cm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td><strong>Which is a social impact of the Cumbrian floods?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Four bridges were destroyed</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>People had to be evacuated</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Insurance claims were said to be over £325 million</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td><strong>Which is an economic impact of the Cumbrian floods?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Four bridges were destroyed</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>People had to be evacuated</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Insurance claims were said to be over £325 million</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td><strong>How do the Environmental Agency help reduce the risks of flooding?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>They send out flood warnings</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>They provide emergency services such as helicopters</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The provide money to help with the clean up</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Stretch: Practice Questions:**

2. Complete the table below to explain the factors that affect hazard risk.

<table>
<thead>
<tr>
<th>Factors affecting hazard risk</th>
<th>Hazard risk is affected because...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population increase</td>
<td></td>
</tr>
<tr>
<td>Urbanisation</td>
<td></td>
</tr>
<tr>
<td>Economic development</td>
<td></td>
</tr>
<tr>
<td>Geographical location</td>
<td></td>
</tr>
<tr>
<td>Increase in the frequency and magnitude of a natural hazard</td>
<td></td>
</tr>
</tbody>
</table>

3. Describe the global distribution of earthquakes and volcanoes.

___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
4. Complete the table below to show the physical processes that occur at each plate margin.

<table>
<thead>
<tr>
<th>Plate margin (sketch)</th>
<th>Direction of plate movement</th>
<th>Physical processes</th>
<th>Earthquakes</th>
<th>Volcanic eruptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constructive</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Destructive</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conservative</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5. What is the difference between a primary and secondary effects of an earthquake? 

6. Identify the primary and secondary effects of an earthquake.

<table>
<thead>
<tr>
<th>Primary effects of an earthquake</th>
<th>Secondary effects of an earthquake</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7. High income countries (HICs) are better equipped to deal with natural hazards compared to low income countries (LICs). Do you agree? Explain your answer.

___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________