

## NATURAL HAZARDS

### 1) What is a natural hazard?

A natural event that has a huge social impact.

### 2) How can natural hazards be classified? Can you name at least one example from each category?

Atmospheric (rain, lightning, snow, drought, hurricanes, tornadoes, wind)

Geological (volcano, mudflow, avalanche, landslide, earthquake)

Flooding (tsunami)

### 3) Why do people continue to live in areas at risk from natural hazards?

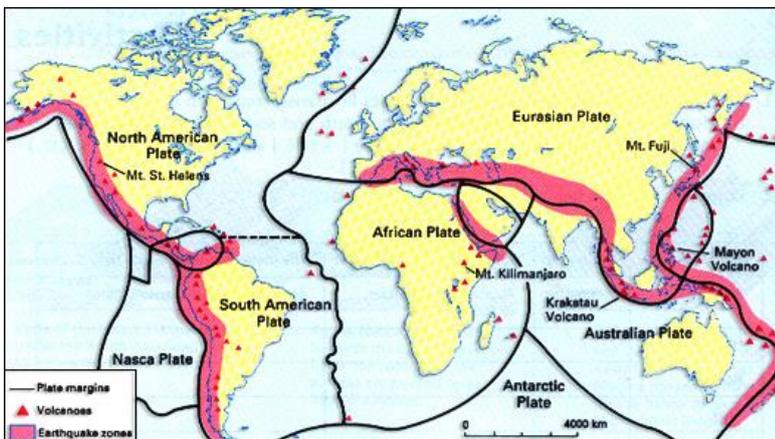
- They have lived there all their lives, have family there, can't afford to move.
- They have a job e.g. tourism in Mt Fuji National Park, Japan.
- They believe there are adequate protection in place e.g. earthquake proof buildings in Kobe, Japan
- They farm on the fertile land – e.g. fertilised by River floods – banks of the Ganges or fertile due to volcanic eruptions e.g. citrus farms on the slopes of Mt Etna.

## TECTONIC HAZARDS

### 1) What is meant by the theory of plate tectonics?

The outer rigid layer of the earth, the lithosphere (crust), is divided into a number of plates that move around very slowly over the upper mantle.

### 2) Describe the global distribution of volcanoes and earthquakes



\*\*\*Remember **PDA** (pattern, detail, anomaly)

**P:** Volcanoes and earthquakes occur in similar locations. They occur in lines / belts along plate margins.

**D:** For example there is a line of volcanoes and earthquakes along the west coast of North and South America. There is a line down the middle of the Atlantic Ocean. There is a ring of tectonic activity around the edge of the Pacific plate called the Pacific Ring of Fire.

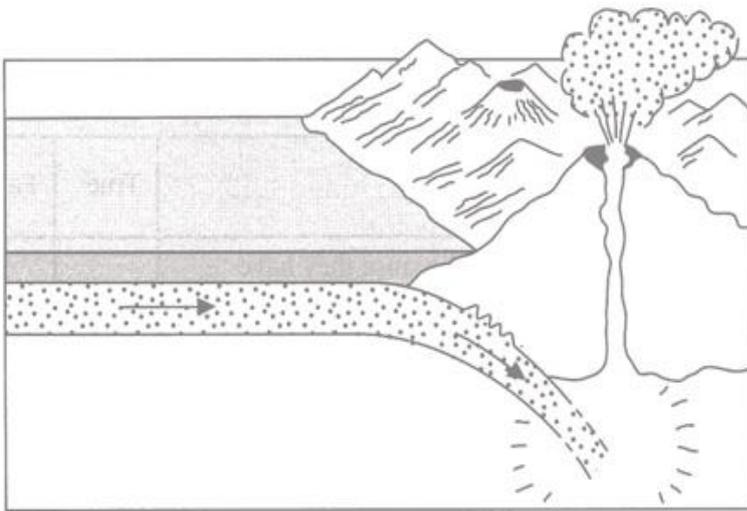
**A:** There is a volcano in the middle of the Pacific plate.

### 3) Compare oceanic and continental crust

Oceanic: denser (so sinks), is destroyed as it sinks into the mantle, younger.

Continental: less dense – floats, permanent (doesn't get destroyed), older

### 4) Draw and label a destructive plate boundary



Oceanic crust is more dense and sinks into the mantle.

Oceanic and continental plates move towards each other.

Friction between the two plates causes earthquakes.

As the oceanic crust subducts it melts and the increase in heat and pressure causes violent volcanic eruptions.

Volcano

Ocean trench

### 5) In which direction do plates move at a destructive boundary?

Oceanic crust moves towards continental crust.

### 6) Why is the oceanic crust subducted along a destructive plate margin?

It is more dense (heavier) than the continental crust so sinks.

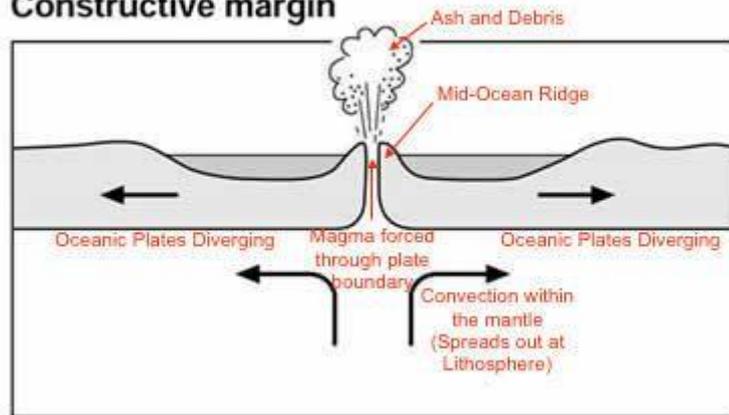
### 7) In which direction do plates move at a constructive plate margin?

Two plates move away from each other.

### 8) Read the description and draw a labelled diagram to show the constructive plate margin

- Plates move away from each other and magma rises. As it breaks through the crust it causes earthquakes.
- The magma rises to fill the gap causing gentle volcanic eruptions. The lava that erupts through the gaps is runny and spreads out before cooling forming shield volcanoes (wide base and gentle slopes).
- As the magma cools it forms new oceanic crust. The magma builds up over time and oceanic ridges are formed under the sea.

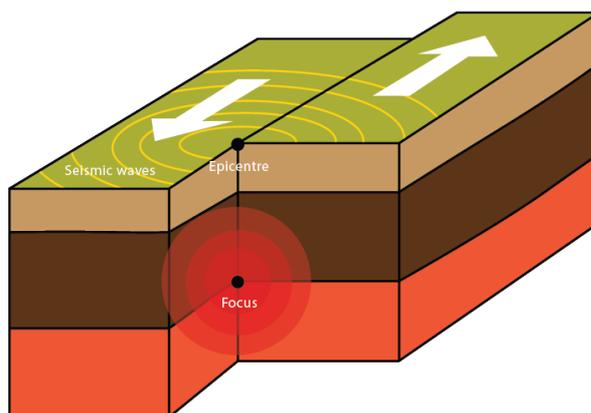
### Constructive margin



9) In which direction do plates move at a conservative plate margin?

Two plates slide past each other either in the same or opposite directions.

10) Draw a labelled diagram of a conservative boundary and explain how earthquakes occur here.



Two plates slide past each other. The rocks between them get stuck and pressure begins to build up. Eventually the rock breaks at the focus and the energy is released. Seismic waves of energy travel out in all directions. It is felt on the surface of the earth as an earthquake. The point on the earth's surface directly above the focus is called the epicentre.

11) What is the difference between primary and secondary effects of earthquakes?

Primary effects happen immediately. Secondary effects usually occur as a result of the primary effects.

12) Give 3 primary effects of an earthquake

People die, people are injured, ports and airports are damaged, homes, schools hospitals etc. collapse.

13) Give 3 secondary effects of an earthquake

Landslides and avalanches, roads and railways are damaged by landslides, tsunamis, people are homeless, diseases spread, lack of clean drinking water.

**14) Name an earthquake you have studied in a HIC and give the key facts**

- L'Aquila in Italy.
- On 6<sup>th</sup> April 2009 at 3.32am an earthquake measuring 6.3 on the Richter Scale. Italy is a HIC with a GDP of \$34,280.
- The earthquake was caused by the collision of the African and Eurasian plates (both continental).
- The earthquake was so destructive because the focus was relatively shallow, a depth of 6.2 miles

**15) Give 3 primary effects of the L'Aquila earthquake?**

- Up to 15,000 buildings collapsed, including churches, medieval buildings and monuments with considerable cultural value. Damaged sites included Basilica of St Bernardino and the National Museum.
- 308 people were killed
- 1500 people were injured

**16) Give 3 secondary effects of the L'Aquila earthquake.**

- Aftershocks triggered landslides and rockfalls, causing damaged to housing and transport
- A landslide and mudflow was caused by a burst main water supply pipeline near the town of Paganio
- 67,500 were made homeless

**17) Give three immediate responses to the L'Aquila earthquake**

Within an hour the Italian Red Cross was searching for survivors, this was helped by seven dog units, 36 ambulances and a temporary hospital.

For those made homeless, hotels provided shelter for 10,000 people and 40,000 tents were given out.

The Italian Post Office offered free mobile phones, raised donations and gave free delivery for products sold by small businesses.

**18) Give three long term responses to the L'Aquila earthquake**

Residents did not have to pay taxes during 2010.

Students were given free public transport, discounts on educational equipment and were exempt from university fees for three years.

Homes took several years to rebuild and historic centres are expected to take at least 15 years to rebuild.

**19) Name an earthquake you have studied in a LIC and give the key facts**

- Nepal
- Nepal is a LIC with a GDP of \$730.
- On Saturday, April 25, 2015 at 12.50am a massive 7.8 magnitude earthquake struck the Gorkha District in Nepal. The epicentre was in Barpak, 80 kilometres northwest of the capital of Kathmandu.
- The area is on a destructive margin where the Indo-Australian plate is colliding with the Eurasian plate at a rate of 45mm per year.
- The focus of the earthquake was relatively shallow, only 6.8 miles deep, contributing to its strength and the resulting damage.

**20) Give three primary effects of the Nepal earthquake**

9000 people died and 20,000 were injured.

3 million were left homeless.

26 hospitals and 50% of schools were destroyed.

**21) Give three secondary effects of the Nepal earthquake**

The earthquake triggered an avalanche which swept through Everest base camp killing 19 people.

Ground shaking triggered landslides and avalanches which blocked roads and hampered relief efforts.

A landslide blocked the Kali Gandaki river, 140km (90 miles) north west of the capital Kathmandu. Many people were evacuated in case of flooding.

**22) Give three immediate responses to the Nepal earthquake**

Temporary shelters were set up. The Red Cross provided tents for 225,000 people.

Helicopters rescued many people caught in avalanches on Mount Everest and delivered supplies to villages cut off by landslides.

Search and rescue teams, water and medical support arrived quickly from countries such as UK, India and China.

**23) Give three long term responses to the Nepal earthquake**

Thousands of homeless people had to be re-housed. There were stricter controls on building codes.

Nepal's government carried out a post-disaster needs assessment. It reported that 23 areas required rebuilding such as schools, hospitals, roads, monuments and agriculture. Eight months after the earthquake it was reported that US\$274million of aid had been committed to the recovery efforts.

A recovery phase started six months later by the Food and Agriculture Organisation (FAO) of the United Nations. To expand crop production and growing seasons individuals were trained

how to maintain and repair irrigation channels damaged by landslides in the earthquake.

#### **24) Why would the effects of responses to earthquakes in LICs be different to the response in HICs**

Examples include: HICs are better prepared, they have more money to build earthquake proof buildings. More resources are available to monitor and predict earthquakes in HICs compared to LICs. HICs there is better medical care for people so fewer people die from their injuries.

#### **25) How can the risk from tectonic hazards be reduced?**

### **MPPP**

- ✓ Monitoring: using scientific equipment to detect warning signs of events such as volcanic eruptions.
- ✓ Prediction: Using historical evidence and monitoring scientists can make predictions about when and where a tectonic hazard may happen.
- ✓ Protection: designing buildings that will withstand tectonic hazards.
- ✓ Planning: identifying and avoiding places most at risk.

#### **26) Give an example of MONITORING for both volcanoes and earthquakes**

Instruments can be used to detect gas escaping from the volcano that is produced as magma rises.

Earthquakes usually occur without warning but sometimes there are minor tremors before the big one, these are detected using seismometers.

#### **27) Give an example of PREDICTING for both volcanoes and earthquakes**

Volcanoes are monitored by scientific equipment that records changes in gases, earthquakes occurring beneath the volcano, laser beams that detect changes in the ground. All this information is used to predict when the volcano might erupt.

It is impossible to make accurate predictions of when and earthquake will occur but studying historical records of earthquake activity could suggest when an earthquake may occur again.

#### **28) Give an example of PROTECTION for both volcanoes and earthquakes**

Earth embankments or explosives can be used to divert lava flows away from people and property, for example on the slopes of Mt Etna in Italy.

To protect against earthquakes in Japan earthquake proof buildings are built using flexible steel and shock absorbers in the foundations. Regular earthquakes drills help keep people alert and be prepared.

#### **29) Give an example of PLANNING for both volcanoes and earthquakes**

Hazard maps have been produced for areas with dangerous volcanoes, these show the areas likely to be affected. These are used in planning to restrict certain land uses or to identify

which areas need to be evacuated when an eruption is about to happen.

Maps are produced to identify those areas most at risk from earthquake damage. High-value land uses e.g. hospitals and reservoirs can then be protected in vulnerable areas.

## WEATHER HAZARDS

### 1) What does global atmospheric circulation mean?

Global atmospheric circulation is the circular movement of air in the atmosphere in cells. These cells joined together form the overall circulation of the Earth's atmosphere and explain the location of world climate zones.

### 2) What are the characteristics of high pressure weather systems?

Cold, dense air

Descending (sinking) air

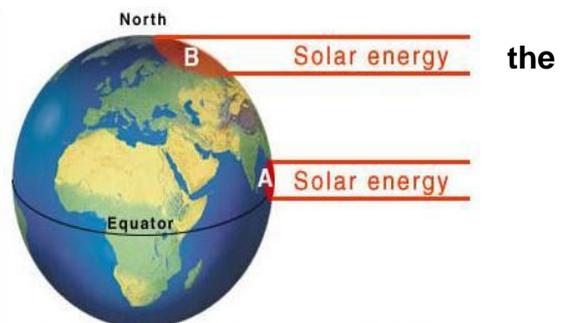
Clear skies, dry.

### 3) What are the characteristics of low pressure weather systems?

Air is heated & becomes less dense so rises.

The rising air cools & condenses forming clouds.

### 4) Use the diagram to explain why temperatures fall as you move away from equator.



Due to the curved surface of the Earth, the Equator receives much higher insolation than at the polar latitude. The solar radiation has to travel further to reach the poles and then has to heat a larger surface area at the poles compared to the equator due to the curve of the earth's surface.

### 5) Describe what happens to the air at the equator as a result of the concentrated solar energy.

The air at the equator is heated strongly. It becomes less dense and rises = low pressure zone called the *Equatorial low*. As it rises it spreads out and moves towards the North & South Poles.

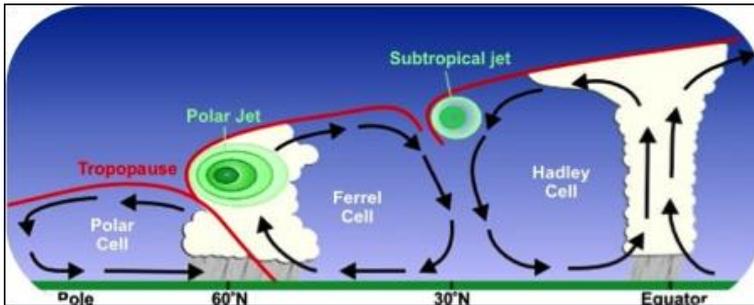
## 6) Why is there high pressure at the poles?

As there is low insolation at the polar latitudes this results in colder, dense air and high pressure called the *Polar high*. As the air sinks it spreads out towards the equator.

## 7) How many convection cells are there in global atmospheric circulation? Can you name them?

There are 3 convection cells.

Polar cell. Ferrell cell. Hadley cell.



## 8) What is the Coriolis effect?

The winds on the Earth's surface bend (curve) as the Earth spins.

The movement of the Earth on its axis generates strong winds. These winds flow towards the east as the Earth spins.

The winds curve as they move from areas of high pressure to areas of low pressure.

The Earth is far wider at the Equator than at the poles so the Earth has to spin faster – the difference in speed causes the winds to curve.

## 9) Where do tropical storms form?

Tropical storms form over warm oceans, where the sea temperature is above 27°C to a depth of 60-70 metres.

## 10) Where do tropical storms occur?

Most tropical storms form between 5-15° to the north and south of the Equator.

## 11) Why do tropical storms not occur at the Equator?

At the Equator the Coriolis effect is not strong enough to make the tropical storms spin.

## 12) Describe the sequence of formation of tropical storms

- A strong upward movement of air draws water vapour up from the warm ocean surface.
- This evaporated air cools as it rises and condenses to form towering thunderstorm clouds.
- As the air condenses it releases heat which powers the storm and draws up more and more

water from the ocean.

- Several small thunderstorms join together to form a giant spinning storm. When surface winds reach an average of 120km per hour (75 miles per hour) the storm officially becomes a tropical storm.
- The storm now develops an eye at its centre where air descends rapidly. The outer edge of the eye is where the most intense weather conditions (strong winds and heavy rain) are felt.
- As the storm is carried across the ocean by the prevailing winds, it continues to gather strength.
- On reaching the land the storm's energy supply (evaporated water) is cut off. Friction with the land slows it down and it begins to weaken. If the storm reaches warm sea after crossing the land it may pick up strength again.

### **13) Why do the winds in tropical storms blow in different directions in the northern and southern hemisphere?**

It is due to the Coriolis effect which bends and spins the warm rising air. Hurricanes in the northern hemisphere bend to the right, which causes the clouds to swirl anticlockwise, whereas cyclones in the southern hemisphere swirl in a clockwise direction.

- The Coriolis effect bends and spins the warm rising air. Hurricanes in the northern hemisphere bend to the right, which causes the clouds to swirl anticlockwise, whereas cyclones in the southern hemisphere swirl in a clockwise direction.

### **14) Explain two ways climate change will affect tropical storms**

- As temperatures increase sea levels will rise due to **thermal expansion**. The impact of rising sea levels will mean **storm surges** are expected to become much higher.
- A warmer atmosphere will mean the air can hold more moisture. Heavy rainfall is expected to increase. Flooding during a tropical storm will be more destructive.

### **15) What does distribution mean?**

How something is spread over an area. E.g. where in the world do tropical storms occur.

*Remember when describing distribution use PDA (pattern, detail, anomaly)*

### **16) What does frequency mean?**

How often something occurs. E.g. how often tropical storms occur.

### **17) What does intensity mean?**

How strong something is e.g. the strength of the tropical storm.

### **18) What is the Saffir-Simpson scale?**

It is the scale used to measure the strength of hurricane winds. It is a scale of 1-5.

### **19) Which tropical storm case study will you use? Give the key facts.**

- Typhoon Haiyan.
- 8th November 2013, Typhoon Haiyan, a category 5 typhoon struck the Philippines.
- It was one of the most powerful storms ever recorded, classed as a 'super' typhoon – sustained winds over 150mph
- Strong winds up to 170mph battered homes and buildings.
- The province of Leyte took the full force of the storm and the city of Tacloban was one of the worst affected places with 90% of the city destroyed.

**20) Give three primary effects of Typhoon Haiyan**

About 6300 people were killed, drowned by the storm surge.

Over 600,000 people were displaced, 40,000 homes were damaged or destroyed.

30,000 fishing boats were destroyed.

**21) Give three secondary effects of Typhoon Haiyan**

14 million people were affected, many left homeless.

6 million people lost their source of income.

Power supplies in some areas were cut off for a month.

**22) What were three immediate responses to Typhoon Haiyan?**

Over 1200 evacuation centres were set up to help the homeless.

International government and aid agencies responded quickly with food aid, water and temporary shelters.

US aircraft carrier George Washington and helicopters assisted with search and rescue and delivery of aid.

**23) What were three long term responses to Typhoon Haiyan?**

'Cash for work' programmes – people paid to help clear debris and rebuild the city.

Rice farming and fishing quickly re-established. Aid agencies such as Oxfam supported the replacement of fishing boats – a vital source of income.

More cyclone shelters built to accommodate people evacuated from coastal areas.

**24) How was Typhoon Haiyan predicted / monitored?**

The course (track) of the storm is monitored using satellites and the track the storm will take is

predicted so people can be evacuated from areas.

### **25)How can the effects of tropical storms be reduced?**

Monitoring

Prediction

Protection

Planning

### **26)How can the effects of tropical storms be reduced through PROTECTION?**

Windows, doors and roofs reinforced to withstand strong winds.

Storm drains constructed in urban areas to take the excessive amounts of rainfall and prevent flooding.

Sea walls built to protect properties from storm surges.

Houses close to the coast are built on stilts so that a storm surge will pass beneath.

E.g. in Bangladesh nearly 2000 cyclone shelters have been built. They are constructed of strong concrete, they have shutters over the windows, they are built on stilts, they are constructed on raised ground.

### **27)How can the effects of tropical storms be reduced through PLANNING?**

This is about raising the awareness of communities and individuals to the hazard of tropical storms. People need to understand the danger and how to respond. E.g. in the USA there is a National Hurricane Preparedness Week which focuses on educating people about potential dangers ahead of the next hurricane season. Families are encouraged to devise their own plan of action should a warning be issued.

### **27)What is weather?**

The day to day conditions in the atmosphere including temperature, the amount of cloud, strength and direction of the wind or whether it is raining.

### **28)What is climate?**

The average weather conditions of a place looking at data taken over a 30 year period.

### **29)What extreme weather event case study will you use for the UK? What are the main case study facts?**

- Somerset Levels
- An area of low lying farmland and wetlands in south-west England.
- Experienced flooding in January 2014.
- Several rivers flow through the area e.g. River Parrett and River Tone.

### **30)What caused the 2014 Somerset floods?**

- It was the wettest January since records began.

- About 350mm of rain fell in January, 100mm above average.
- High tides and storm surges swept up the Bristol Channel. This prevented fresh water reaching the sea and it spilled over the river banks.
- Rivers had not been dredged for at least 20 years and they were clogged with sediment.

**31)What are three SOCIAL impacts of the Somerset floods?**

- Over 600 homes were flooded.
- Villages such as Moorland and Muchelney were cut off. This affected people's daily lives e.g. attending school and shopping.
- Residents evacuated to temporary accommodation for months.

**32)What are three ECONOMIC impacts of the Somerset floods?**

- Somerset County Council estimated the cost of the flood damage to be more than £10 million.
- Over 14,000 ha of agricultural land under water for 3-4 weeks.
- Local roads cut off by floods.

**33)What are three ENVIRONMENTAL impacts of the Somerset floods?**

- Floodwaters were heavily contaminated with sewage and other pollutants including oil and chemicals.
- A huge amount of debris had to be cleared.
- Stagnant water that had collected for months had to be re-oxygenated before being pumped back into the rivers.

**34)What were the IMMEDIATE responses to the Somerset floods?**

- Villagers cut off by the floods used boats to go shopping or attend school.
- Local community groups and volunteers gave support.

**35)What were four LONGER-TERM responses to the Somerset floods?**

- A £20 million Flood Action Plan was launched by Somerset County Council who will work with agencies such as the Environment Agency to reduce the risk of future flooding.
- In March 2014, 8km of the Rivers Tone and Parrett were dredged to increase the capacity of the river channel.
- Road levels have been raised in places to maintain communications and enable businesses to continue during future flood events.
- River banks are being raised and strengthened and more pumping stations will be built.

**36)Why might extreme weather events be on the increase?**

- a) More **energy in the atmosphere** could lead to more intense storms.
- b) The **atmospheric circulation**, we studied at the beginning of the weather topic may be

affected – this would bring floods to normally dry regions and heatwaves to normally cooler areas.

### **37) Why would the UK weather become wetter with global warming?**

- A warmer world will be one where more evaporation takes place over the oceans – what goes up must come down! Climate change scientists believe rainfall patterns in the UK are likely to change as oceans warm and may already be doing so.
- As the Atlantic Ocean warms up rain-bearing depressions will gain more energy and moisture.

### **38) What is the Quaternary period?**

The last 2.6 million years.

### **39) Describe what has happened to global temperatures over the last 5 million years.**

Temperatures have fluctuated a great deal although there has been a gradual cooling.

### **40) What has happened to global temperatures since 1880?**

The average temperature has risen by 0.85°C. Most of this increase has occurred since the mid-1970s.

### **41) What are three natural causes of climate change?**

- a) Changes in the earth's orbit – Milankovitch cycles (eccentricity, tilt of the earth's axis & precession)
- b) Solar activity
- c) Volcanic activity

### **42) What is the greenhouse effect?**

The earth's atmosphere allows heat from the sun (short-wave radiation) to pass straight through and warm up the earth's surface. However, when the Earth gives off heat in the form of long-wave radiation, some gases such as carbon dioxide and methane trap the heat warming the Earth's atmosphere.

### **43) Are humans causing climate change?**

Although there are natural causes of climate change, they cannot account for the increases in temperature seen since the 1970s.

There is a clear link between the increase in carbon dioxide emissions and rising temperatures.

#### **44) Give three ways in which humans contribute to climate change.**

Burning fossil fuels – this accounts for over 50% of greenhouse gas emissions. Fossil fuels are used in transport, building, heating homes and manufacturing industry.

Agriculture - Cattle produce methane during digestion and microbes produce it as they decay organic matter under the water of flooded rice paddy fields. As the world's population increases, more food is required, especially in areas such as Asia where rice is the staple diet.

Deforestation - Clearing land for agriculture so that farmers have space to plant crops and graze livestock. Logging for wood and paper products. Building roads to access remote areas. Making room for the expansion of urban areas

#### **45) What does mitigation mean?**

Mitigation strategies can be local or global and deal with the cause of the problem. They **reduce or prevent** the greenhouse gases which cause climate change and protect carbon sinks such as forests and oceans.

#### **46) Name four methods of mitigation when tackling climate change.**

Alternative sources of energy

Carbon capture and storage

Planting trees

International agreements

\*\*\* Make sure you understand what each of these involves and the advantage & disadvantage of the method.

#### **47) What does adaptation mean when tackling climate change?**

Adaptation **responds** to the impacts of climate change and tries to **make populations less vulnerable**.

Adaptation strategies are local rather than global, to respond to the localised impacts.

#### **48) Give three ways we can adapt to climate change**

Agricultural adaptation in the mid and low latitudes.

Managing water supply.

Reducing the risk from sea level rise.

\*\*\* Make sure you understand what each of these methods involves and describe a real example for each.

# **Natural Hazards**

## **Unit 1**

### **How to use:**

- **Use the key questions and answers to check your knowledge.**
- **Ask your family or friends to test you.**
- **Use the questions and answers to make revision notes for the topic.**

**\*\*** These questions cover most of the unit but you will need to refer to your notes for the full content. You will be expected to discuss some of these areas in much more detail in the exam. For the case study questions there are answers other than those given in the booklet.

