UNIT 1: Physical Geography

This exam is 1hr 30m long and is out of 88

It has 3 sections and 5 questions (**you only answer Q1-4**)

- Section A – **Natural Hazards** Q1 – Answer **ALL** questions (33/88)
- Section B – **Living World** Q2 – Answer **ALL** questions (25/88)
- Section C – **Physical Landscapes** Q3-5 – **Answer Q3 & 4 ONLY** (each Q worth 15/88)

Unit 1a
The Challenge of Natural Hazards

AQA

What are Natural Hazards?

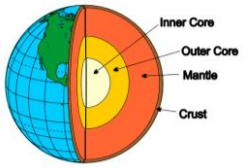
Natural hazards are physical events such as earthquakes and volcanoes that have the potential to do damage to humans and property. Hazards include tectonic hazards, tropical storms and forest fires.

What affects hazard risk?

Population growth
Global climate change
Deforestation
Wealth - LICs are particularly at risk as they do not have the money to protect themselves

Structure of the Earth

The earth has 4 layers
The core (divided into inner and outer), mantle and crust.



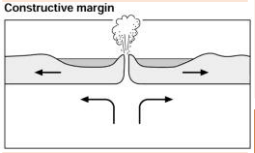
The crust is split into major sections called **tectonic plates**.

There are 2 types of crust: **Oceanic** (thin and younger but dense) and **Continental** (old and thicker but less dense).

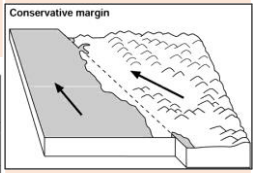
These plates move due to convection currents in the mantle and, where they meet, tectonic activity (volcanoes and earthquakes) occurs..

Plates either move towards each other (**destructive** margin) away from each other (**constructive**) or past each other (**conservative**).

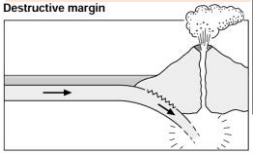
Constructive margin



Conservative margin



Destructive margin



Earthquakes and Volcanoes

Volcanoes	Earthquakes
- **Constructive** margins – Hot magma rises between the plates e.g. Iceland. Forms Shield volcanoes. - **Destructive** margins – an oceanic plate subducts under a continental plate. Friction causes oceanic plate to melt and pressure forces magma up to form composite volcanoes e.g. the west coast of South America.	- **Constructive** margins – usually small earthquakes as plates pull apart. - **Destructive** margins – violent earthquakes as pressure builds and is then released. - **Conservative** margins – plates slide past each other. They catch and then as pressure builds it is released e.g. San Andreas fault.

Effects of Tectonic Hazards

Primary effects happen immediately. Secondary effects happen as a result of the primary effects and are therefore often later.

Primary - Earthquakes	Secondary - Earthquakes
- Property and buildings destroyed. - People injured or killed. - Ports, roads, railways damaged. - Pipes (water and gas) and electricity cables broken.	- Business reduced as money spent repairing property. - Blocked transport hinders emergency services. - Broken gas pipes cause fire. - Broken water pipes lead to a lack of fresh water.
Primary - Volcanoes	**Secondary - Volcanoes**
- Property and farm land destroyed. - People and animals killed or injured. - Air travel halted due to volcanic ash. - Water supplies contaminated.	- Economy slows down. Emergency services struggle to arrive. - Possible flooding if ice melts Tourism can increase as people come to watch. - Ash breaks down leading to fertile farm land.

Responses to Tectonic Hazards

Immediate (short term)	Long-term
- Issue warnings if possible. **- Rescue teams search for survivors.** **- Treat injured.** **- Provide food and shelter, food and drink.** **- Recover bodies.** **- Extinguish fires.**	**- Repair and re-build properties and infrastructure.** **- Improve building regulations** **- Restore utilities.** **- Resettle locals elsewhere.** **- Develop opportunities for recovery of economy.** **- Install monitoring technology.**

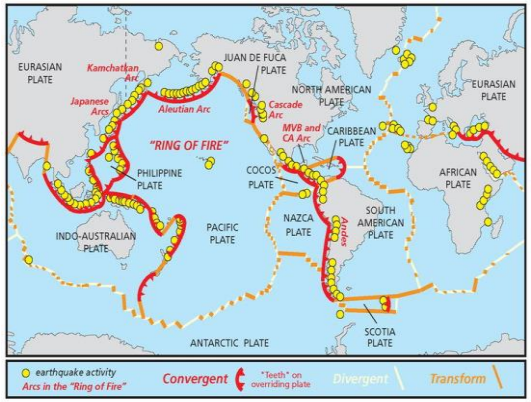
Comparing Earthquakes – Haiti (LIC) and Kobe (HIC)

Haiti. Jan 2010. Magnitude 7.0.	Kobe Jan 1995. Magnitude 7.2.
Primary Effects	
Deaths 316,000 Injured 300,000 Wide scale devastation – presidential palace collapsed so little hope for those living in slums and shanty towns e.g. Cite Soleil Roads blocked by rubble Cost of damage $30bn	Deaths 5,000 Newer buildings earthquake proof, but 102,000 older buildings collapsed Electricity and water supplies disrupted Phone communications disrupted Major expressway collapsed Cost of damage $100bn
Secondary Effects	
Looting People forced into tented shelters Strong aftershocks Disease (Cholera) spread Damaged transportation	Fires from broken gas mains Homeless moved into well-built shelters The economy suffered as there was $220 billion in damage. Companies like Panasonic had to close temporarily.
Immediate Responses	
Haiti needed foreign workers to help USAID with personnel, rescue dogs, and cutting equipment $100m in aid given by USA and $330m by EU UN flying in emergency food supplies Oxfam sending clean water, sanitation and shelter 4.3 million people provided with food rations	Government well prepared for earthquakes Japanese troops sent to help the people immediately Water, electricity, gas services were fully working by July 1995 Major retailers gave supplies to people affected Motorola maintained free mobile comms
Long term responses	
100m by World Bank to help with rebuilding 200,000 people received cash or food for clearing rubble	New buildings even more earthquake proof. More instruments to monitor earthquake movements

LICs suffer more than HICs from natural disasters because they are not as prepared and struggle to react effectively.

Distribution of tectonic activity

Along plate boundaries.
On the edge of continents.
Around the edge of the Pacific.

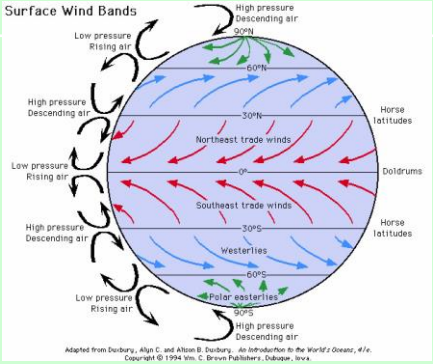


Reducing the impact of tectonic hazards

Monitoring	Prediction
Seismometers measure earth movement. Volcanoes give off gases.	**By observing monitoring data, this can allow evacuation before event.**
Protection	**Planning**
Reinforced buildings and making building foundations that absorb movement. Automatic shut offs for gas and electricity.	**Avoid building in at risk areas. Training for emergency services and planned evacuation routes and drills.**

Global atmospheric circulation

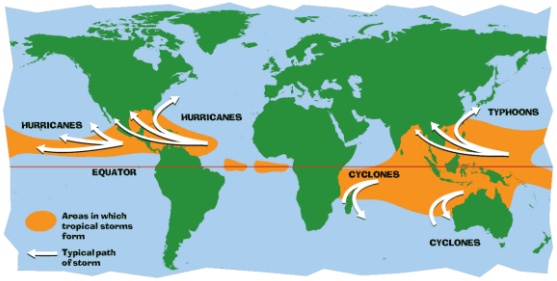
At the equator, the sun's rays are most concentrated. This means it is hotter. This one fact causes global atmospheric circulation at different latitudes.



High pressure = dry
Low pressure = wet
As the air heats it rises – causing low pressure. As it cools, it sinks, causing high pressure. Winds move from high pressure to low pressure. They curve because of the **Coriolis** effect (the turning of the Earth)

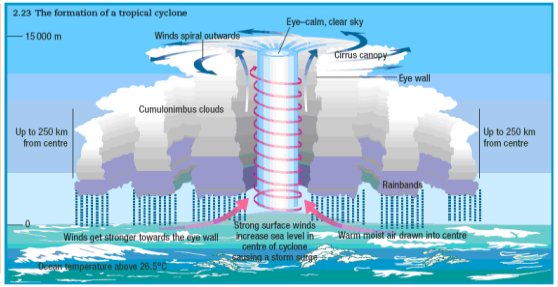
Tropical Storms

Occur in low latitudes between 5° and 30° north and south of the equator (in the tropics). Ocean temperature needs to be above 27° C. Happen between summer and autumn.



Sequence of a Tropical Storm

1. **Air is heated above warm tropical oceans.**
2. **Air rises under low pressure conditions.**
3. **Strong winds form as rising air draws in more air and moisture causing torrential rain.**
4. **Air spins due to Coriolis effect around a calm eye of the storm.**
5. **Cold air sinks in the eye so it is clear and dry.**
6. **Heat is given off as it cools powering the storm.**
7. **On meeting land, it loses source of heat and moisture so loses power.**



Climate change will affect tropical storms too. Warmer oceans will lead to more intense storms – but not necessarily more frequent ones.

Extreme weather in the UK

Rain – can cause flooding damaging homes and business.
Snow & Ice – causes injuries and disruption to schools and business. Destroys farm crops.
Hail – causes damage to property and crops.
Drought – limited water supply can damage crops.
Wind – damage to property and damage to trees potentially leading to injury.
Thunderstorms – lightening can cause fires or even death.
Heat waves – causes breathing difficulties and can disrupt travel.

UK weather is getting more extreme due to climate change. Temperatures are more extreme and rain is more frequent and intense leading to more flooding events. Since 1980 average temperature has increased 1 degree and winter rainfall has increased.

Hurricane Katrina, USA, August 2005

Primary Effects	Secondary Effects
At least 1800 killed 120 mph wind speeds 300,000 houses destroyed Levees broke Coastal habitats damaged 80% New Orleans flooded	$150bn of damage Water supply polluted 230,000 jobs lost from damaged businesses 200,000 people made homeless Dehydration of people awaiting rescue
Immediate Responses	**Long-term Responses**
70-80% of New Orleans evacuated before the hurricane struck Mississippi & Louisiana declared states of emergency and set up control centres, emergency shelters & supplies Coastguard, police, fire and army rescued 50,000 people Charities gave aid including millions of hot meals	US Government gave $16bn for rebuilding homes and funds for other infrastructure New homes built on stilts or not at all in high risk areas Repaired and improved flood defences costing $14.5bn

Prediction	Planning	Protection
Monitoring wind patterns allows path to be predicted. Use of satellites to monitor path to allow evacuation	Avoid building in high risk areas Emergency drills Evacuation routes	Reinforced buildings and stilts to make safe Flood defences e.g. levees and sea walls Replanting Mangroves

Nov-Dec 2010 – The Big Freeze

A long period of heavy snow and cold weather across the UK because of cold air from northern Europe and Siberia

Social Effects

Several people died from hypothermia or accidents on icy roads
Water pipes froze and burst causing leaks. 40,000 homes and businesses left without water for over a week
7,000 schools closed on several occasions meaning parents take time off work

Economic Effects

Overall economic impact was approx. £1.6bn
Transport (roads/rail/air) networks closed causing businesses to lose money
People unable to get to work
Businesses lost money on run-up to Christmas

Environmental impacts

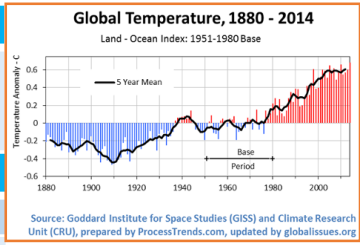
The frost killed crops such as sugar beet
Amount of gas & electricity used to heat homes went up from normal use increasing CO_2 emissions

Management strategies

Met Office issued weather warning of cold weather at the start of Nov.
Councils stocked up on gritters and salt supplies to keep roads open and safe (though not enough)
Emergency services planned to close schools and roads when they became too icy and unsafe

Climate Change – natural or human?

Evidence for climate change shows changes before humans were on the planet. So some of it must be natural. However, the **rate** of change since the 1970s is unprecedented. Humans are responsible – despite what Mr Trump says!



Causes

Natural	Human
- Orbital changes – The sun's energy on the Earth's surface changes as the Earth's orbit is elliptical its axis is tilted on an angle. **- Solar Output** – sunspots increase to a maximum every 11 years. **- Volcanic activity** – volcanic aerosols reflect sunlight away reducing global temperatures temporarily.	**- Fossil fuels** – release carbon dioxide with accounts for 50% of greenhouse gases. **- Agriculture** – accounts for around 20% of greenhouse gases due to methane production from cows etc. Larger populations and growing demand for met and rice increase contribution. **- Deforestation** – logging and clearing land for agriculture increases carbon dioxide in the atmosphere and reduces ability to planet to absorb carbon through photosynthesis.

Effects of Climate Change

Social	Environmental
- Increased disease e.g. skin cancer and heat stroke. - Winter deaths decrease with milder winters. - Crop yields affected by up to 12% in South America but will increase in Northern Europe but will need more irrigation. - Less ice in Arctic Ocean increases shipping and extraction of oil and gas reserves. - Droughts reduce food and water supply in sub-Saharan Africa. Water scarcity in South and South East UK. - Increased flood risk. 70% of Asia is at risk of increased flooding - Declining fish in some areas affect diet and jobs. - Increased extreme weath - Skiing industry in Alps threatened.	- Increased drought in Mediterranean region. - Lower rainfall causes food shortages for orangutans in Borneo and Indonesia. - Sea level rise leads to flooding and coastal erosion. - Ice melts threaten habitats of polar bears. - Warmer rivers affect marine wildlife. - Forests in North America may experience more pests, disease and forest fires. - Coral bleaching and decline in biodiversity.

Managing Climate Change

Mitigation

- **Alternative energy production** will reduce CO_2 production.
- **Planting Trees** – helps to remove carbon dioxide.
- **Carbon Capture** – takes carbon dioxide from emission sources is stored underground.
- **International Agreements** e.g. the Paris Climate Agreement.

Adaptation

- **Changes in agricultural systems** need to react to changing rainfall and temperature patterns and threat of disease and pests.
- **Managing water supplies** – e.g. by installing water efficient devices and increasing supply through **desalination** plants.
- **Reducing risk** from rising sea levels would involve constructing defences such as the Thames Flood Barrier or restoring mangrove forests, or raising buildings on stilts.

Evidence for Climate Change

The Met Office has reliable climate evidence since 1914 – but we can tell what happened before that using several methods.

Ice and Sediment Cores

- Ice sheets are made up of layers of snow, one per year. Gases trapped in layers of ice can be analysed. Ice cores from Antarctica show changes over the last 400 000 years.
- Remains of organisms found in cores from the ocean floor can by traced back 5 million years.

Pollen Analysis

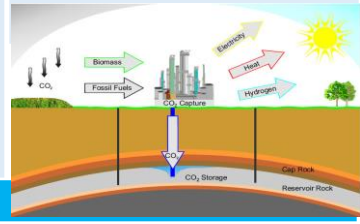
- Pollen is preserved in sediment. Different species need different climatic conditions.

Tree Rings

- A tree grows one new ring each year. Rings are thicker in warm, wet conditions
- This gives us reliable evidence for the last 10 000 years.

Temperature Records

- Historical records date back to the 1850s. Historical records also tell us about harvest and weather reports.



Ecosystem - Key terms

Key term	Definition
Ecosystem	A community of plants and animals that interact with one another and their physical environment.
Abiotic	Relating to non living things.
Biotic	Relating to living things.
Producer	An organism or plant that is able to absorb energy from the sun through photosynthesis.
Primary consumer	Creature that eats plant matter. Also known as a herbivore.
Secondary consumer	Creature that eats other animals. Also known as a carnivore.
Decomposer	An organism that breaks down dead plant and animal matter.
Food chain	The connections between different organisms that rely on one another as their food source.
Food web	A complex hierarchy of plants and animals relying on each other for food.
Biome	A large global ecosystem with flora and fauna adapting to their environment.

Trophic levels

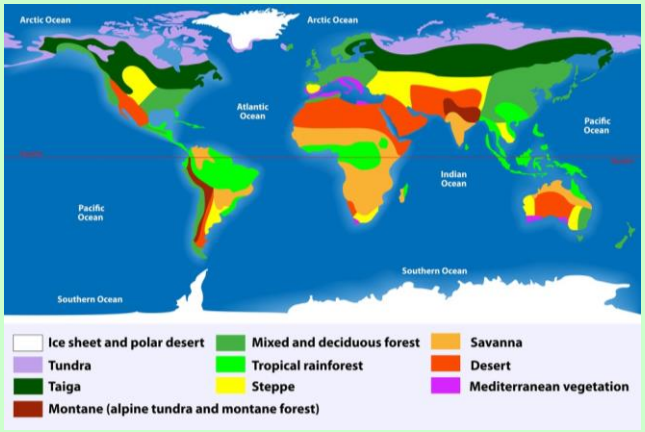
Trophic Level	Source of Energy	Examples
Producers	Solar energy	Green plants, photosynthetic protists and bacteria
Herbivores	Producers	Grasshoppers, water fleas, antelope, termites
Primary Carnivores	Herbivores	Wolves, spiders, some snakes, warblers
Secondary Carnivores	Primary carnivores	Killer whales, tuna, falcons
Omnivores	Several trophic levels	Humans, rats, opossums, bears, racoons, crabs
Detritivores and Decomposers	Wastes and dead bodies of other organisms	Fungi, many bacteria, earthworms, vultures

At each (trophic) level of the food chain the number of individuals declines. This is because not all individuals in any trophic level are consumed (eaten). This means not all energy is passed up to the next trophic level.

Ecosystem - A question of scale

Ecosystems can be any size.
- Local e.g a pond or under a dead log. Also called a habitat.
- Regional e.g. the upland moorland of the Pennines in the north of England.
- Global e.g. tropical rainforest. Also called biomes.

Distribution of Biomes



Biome	Key Characteristics
Tropical Rainforests	•Along equator (Asia, Africa / South America). •6% of earth's surface. •25°C – 30°C and over 250mm rain per month.
Tropical Grasslands (Savanna)	•Between equator and tropics. •20 – 30°C and between 500 - 1500 mm of rain per year. •Wet and dry seasons.
Deserts	•Tropics (Sahara and Australia). •Over 30°C and less than 300 mmm per year rain. •20% of land's surface.
Deciduous forests	•Higher latitudes (W Europe, N America, New Zealand). •5 – 20°C and between 500 – 1500 mm rain per year. •4 distinct seasons. •Lose leaves in the winter to cope with the cold.
Coniferous forest (Taiga)	•60°N (Scandinavia / Canada). •Cone bearing evergreen trees. •No sunlight for part of the year.
Tundra	•Above 60°N (Arctic Circle). •Less than 10°C and less than 500mm per year rain. •Cold, icy and dry means 2 month growing season.

A small scale ecosystem - Bradgate Park

Bradgate Park is a country park to the north west of Leicester. It covers 850 acres and has a wide range of flora (plants) and fauna (animals).

The park attracts almost 1 million visitors each year.

The park has a wide range of trees including oak trees, and small areas of pine trees. There are large areas of bracken. Deciduous trees and bracken provide leaves that decompose and enrich the soil as well as providing leaf litter for insects.

The bracken provides cover and nesting areas for birds such as skylarks, yellowhammers and meadow pipits, as well as cover for the deer in the park. Kingfishers and reed buntings live alongside the River Lin as it flows through the park.

The park is managed by annual deer culls to keep deer numbers at sustainable levels. In the autumn the bracken is rolled flat to encourage nutrients back into the soil and stop the bracken spreading over the grass on which deer graze.

Changes within ecosystems

If any component within an ecosystem is changed it will have a knock on effect on the rest of the ecosystem.
An example of where this happened was in Yellowstone National Park in the USA when they reintroduced wolves in 1995.

16 packs of grey wolves introduced. Each pack kills one elk a day.

Elk population falls from 20,000 to 10,000 in 8 years.

Competition from wolves results in decrease in coyote population.

More kills by wolves = more food for scavengers.

Reduction in grazing pressure. Aspen and cottonwood regenerate. There is more tree cover.

Reduction in predation from coyotes leads to increase in mice and voles.

Increase in populations of grizzly bears, cougars, ravens, magpies and eagles.

Increase in bank side trees stabilises river banks so there is less erosion. More woody debris in rivers creates pools and trout habitats.

Beavers create ponds and flooded areas, which promote growth of aspen.

Regeneration of aspen attracts beavers, which begin to recolonise Yellowstone.

Increased tree cover provides habitats for birds.

Populations of predators of small rodents e.g. red foxes and birds of prey, increase.

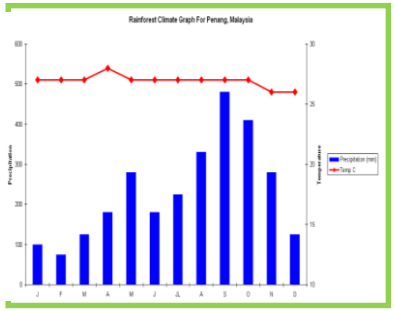
Unit 1b

AQA

The Living World

Rainforest Climate

Temperatures are high all year (around 28°C). Rainfall is around 250mm per month.

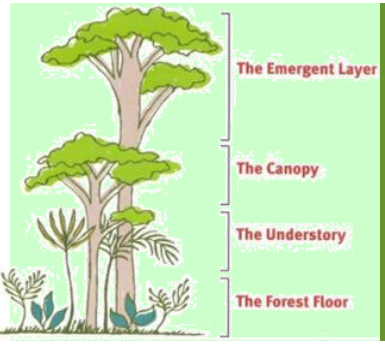


Tropical Rainforest - Animals

- Jaguars have spotted fur. This camouflages them in the dappled shade of the forest floor.
- Parrots have strong, sharp beaks to help them crack open nuts.

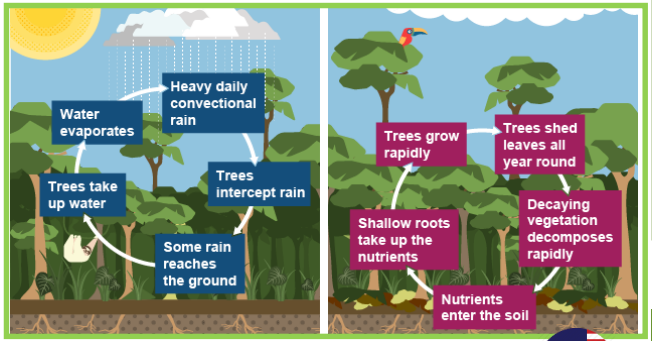
- Spider monkeys have a prehensile tail that allows them to cling to branches. Sharp nails allow them to peel bark.
- Poison dart frogs are a bright colour to warn predators away.

Tropical Rainforest - Vegetation



- Competition for light causes trees to grow fast. They are tall and straight. Buttress roots support these tall trees.
- Plants on the forest floor are shade tolerant and able to cope in the darker conditions.
- Epiphytes grow high up on the branches of trees to gain access to the light.
- Lianas wrap themselves around other trees to gain access to light.
- Plants have drip tips.

Water and Nutrient Cycle



Causes of deforestation in Malaysia

Commercial farming	During the 1970's large areas of forest were cleared for palm oil plantations
Logging	Malaysia became the world's largest exporter of tropical wood in the 1980's. This led to total destruction of forest habitats
Mineral extraction	The removal of mineral resources from the earth. Malaysia mines tin and clears forest for mines and transport networks
Subsistence farming	A type of agriculture producing food and materials for the benefit only of the farmer and his family or community. Small scale, often slash and burn.
Hydro - electricity	The Bakun Dam have been built and large areas (700km²) of rainforest destroyed by flooding.
Resettling	1 million people have been encouraged to move away from squatter settlements and into the rainforest. They have been given land which has been cleared (approx. 15,000 hectares) to allow farming.
Roads	Roads built to access settlements and mines. Opened up rainforest, but allowed loggers in.

Effects of deforestation in Malaysia

Economic development
•Brings in jobs and income. •Destroys resources in the long term. •Livelihoods of locals destroyed. •Products such as palm oil and rubber supply raw materials •Minerals such as gold are very valuable •Hydro-electric Power is cheap and clean energy

Soil erosion
•Land left unprotected from heavy rain leads to landslides and flooding. •Nutrients are washed away decreasing nutrients in the soil. •Rivers silt up.

Contribution to climate change
•Trees cut down change the water cycle and make it drier. •Rainforests are the lungs of the earth and so when deforested there is more carbon dioxide in the air and less oxygen. •Burning also releases carbon dioxide into the air (Greenhouse effect).

Others
•Loss of biodiversity - 137 species a day. •Loss of indigenous tribes (90 since 1990). •Tribal people moving to towns and cities and have drugs and alcohol issues. •Loss of indigenous knowledge. •Conflicts between developers and indigenous people.

Protecting the Rainforest

- **Selective logging**. Only fell fully grown trees. Mark sustainable trees for sale.
- **Conservation & education**. WWF (NGO) educate and train conservation workers. Buy threatened areas.
- **Ecotourism**. Minimises damage to the environment and benefits locals. This creates incentive to protect the forest.
- **International agreements**. International Tropical Trade Agreement restricts trade in hard woods.
- **Debt reduction**. In 2010 the USA converted $13.5 million from Brazil and used to protect forest.

Hot Deserts

NOT hot desserts

To be defined as a Hot Desert, there must be:
-Less than 250mm of rain a year.
- Diurnal temperatures ranging from 50°C during the day to 0°C at night.

Desert - Challenges

Extreme Temperatures Temperatures are over 40 degrees during the day and drop below freezing at night.

Inaccessibility – The Sahara is huge making travel difficult and expensive.

Water Supply - low rainfall makes water for drinking, washing and agriculture difficult to supply.

Desertification - Causes

Desertification is where land is gradually turned into desert, usually on the edge of a desert. It is caused by overgrazing by cattle or trees being cut down for firewood. Population growth is a key factor. Climate change will lead to more droughts that kill vegetation and cause the problem to spread. In the area to the south of the **Sahara**, known as the **Sahel** heavy rainstorms can wash away the exposed soil in a couple of hours.

Desert - Opportunities	Specific Detail
Mineral resources - mineral resources from the earth can be used by industry or sold for export.	Morocco is the world's largest exporter of phosphate which is used in fertilisers and batteries. The money gained can be used to develop the country.
Oil and gas - oil is trapped in huge aquifers deep underground. It is an extremely valuable resource.	Algeria is a leading exporter of oil and gets 60% of its income from the oil and gas industry. It has many huge oilfields e.g. Hassi Messaoud. The industry provides jobs for 40,000 people.
Solar energy - with 12 hours of cloudless sunshine every day, deserts are ideal locations for this form of electricity generation.	Tunisia is planning a huge development that will supply enough electricity to meet the needs of 2 million homes in Western Europe. Solar power does not contribute to global warming.
Tourism – deserts are remote, romantic and exotic locations for tourists. 	You can go camel trekking in Morocco. Cities like Marrakech are popular with many tourists visiting the famous souk (market). Increasing opportunities for sand-boarding and dune buggies exist.
Farming - only possible where there is access to water through irrigation.	Egypt doubled the amount of land where crops were grown by building the Aswan Dam to control the flow of the Nile and irrigate the surrounding desert.

Desertification - Solutions

Irrigation - Water from aquifers used to grow crops / vegetation.

National Parks - Conserve areas at risk, protect wildlife.

Afforestation - Green wall being planted across the Sahel.

Crop rotation - Keeps nutrients in the soil by avoiding monoculture.

Appropriate Technology - Use of suitable crops, magic stones, terraces.

Sahara Desert – Northern Africa

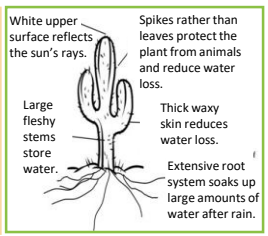
Opportunities •Farming using water from Aswan Dam. •Mineral extraction e.g. phosphates in Morocco & Oil/gas in Algeria. •Energy. Tunisia Solar Project will produce enough energy for 2m homes. •Tourism e.g. camel trekking and dune buggies

Challenges •Temperatures reach up to 50°C. •Lack of roads meant limited access until late 1800s. •Water is limited and has to be transported from aquifers or dams. •Over-extraction leads to conflict. •Conflict with nomadic groups

Desert plants

High temperatures should lead to rapid growth but this is not possible due to the lack of moisture. Vegetation is sparse and usually confined to water holes.

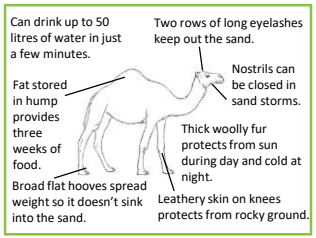
Lack of rainfall is the main limit on plant growth. Plants have thin leaves or spines to reduce water loss and long roots to reach deep underground water. The Cactus is a common desert plant.



Desert Animals

The limited number of producers means the number of consumers is also low.

Animals need to be able to tolerate the range of temperatures in the desert. Many do this by staying underground during the day. They also need to find ways to cope with the limited availability of water. Some gain enough water from their food. Others extract water from air.



Unit 1c
Physical Landscapes in the UK

AQA

Relief of the UK

Relief of the UK can be divided into uplands and lowlands. Each have their own characteristics.

Key

Lowlands

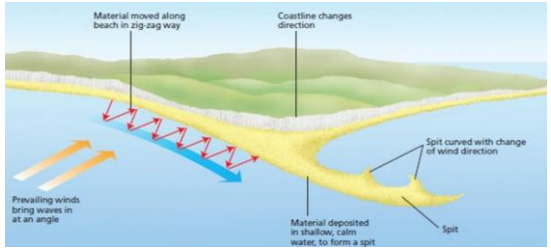
Uplands

Areas +600m: Peaks and ridges cold, misty and snow common. i.e. Scotland

Areas -200m: Flat or rolling hills. Warmer weather. i.e. Fens

Formation of Coastal Spits - Deposition

Example: Spurn Head, Holderness Coast.



1) Swash moves up the beach at the angle of the prevailing wind.
2) Backwash moves down the beach at 90° to coastline, due to gravity.
3) Zigzag movement (Longshore Drift) transports material along beach.
4) Deposition causes beach to extend, until reaching a river estuary.
5) Change in prevailing wind direction forms a hook.
6) Sheltered area behind spit encourages deposition, salt marsh forms.

Types of Erosion

The break down and transport of rocks – smooth, round and sorted.

Attrition	Rocks that bash together to become smooth/smaller.
Solution	A chemical reaction that dissolves rocks.
Abrasion	Rocks hurled at the base of a cliff to break pieces apart or scraped against the banks and bed of a river.
Hydraulic Action	Water enters cracks in the cliff, or river bank, air compresses, causing the crack to expand.

Types of Weathering

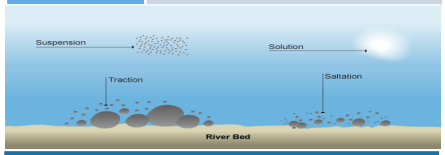
Weathering is the breakdown of rocks where they are.

Biological	Breakdown of rock by plants and animals e.g. roots pushing rocks apart.
Mechanical	Breakdown of rock without changing its chemical composition e.g. freeze thaw

Types of Transportation

A natural process by which eroded material is carried/transported.

Solution	Minerals dissolve in water and are carried along.
Suspension	Sediment is carried along in the flow of the water.
Saltation	Pebbles that bounce along the sea/river bed.
Traction	Boulders that roll along a river/sea bed by the force of the flowing water.

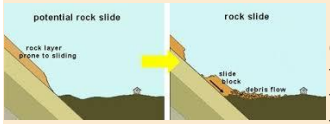


What is Deposition?

When the sea or river loses energy, it drops the sand, rock particles and pebbles it has been carrying. This is called deposition. Heaviest material is deposited first.

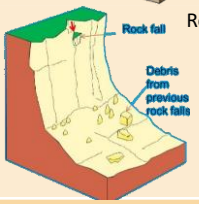
Mass Movement

A large movement of soil and rock debris that moves down slopes in response to the pull of gravity in a vertical direction.



Rock slides occur when there is a failure along the bedding plane.

Slumping occurs when there is a downward rotation of sections of cliff. Often occur after heavy rain.



Rockfall is the rapid free fall of rock from a steep cliff face because of gravity.

Formation of Bays and Headlands

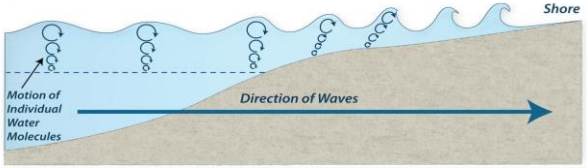
1) Waves attack the coastline.
2) Softer rock is eroded by the sea quicker forming a bay, calm area cases deposition.
3) More resistant rock is left jutting out into the sea. This is a headland and is now more vulnerable to erosion.

How do waves form?

Waves are created by wind blowing over the surface of the sea. As the wind blows over the sea, friction is created - producing a swell in the water.

Why do waves break?

1	Waves start out at sea.
2	As waves approaches the shore, friction slows the base.
3	This causes the orbit to become elliptical.
4	Until the top of the wave breaks over.



Mechanical Weathering Example: Freeze-thaw weathering

Stage One
Water seeps into cracks and fractures in the rock.

Stage Two
When the water freezes, it expands about 9%. This wedges apart the rock.

Stage Three
With repeated freeze-thaw cycles, the rock breaks off.

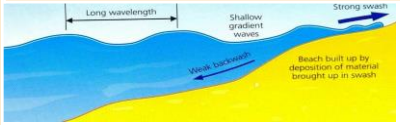
Size of waves

Affected by:
- **Fetch how far the wave has travelled**
- **Strength of the wind.**
- **How long the wind has been blowing for.**

Types of Waves

Constructive Waves

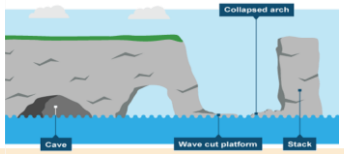
This wave has a **swash that is stronger** than the backwash. This therefore builds up the coast.



Destructive Waves

This wave has a **backwash that is stronger** than the swash. This therefore erodes the coast.

Formation of Coastal Stack



Example: Old Harry Rocks, Dorset

1) Hydraulic action widens cracks in the cliff face over time.
2) Abrasion forms a wave cut notch between high tide and low tide.
3) Further abrasion widens the wave cut notch to from a cave.
4) Caves from both sides of the headland break through to form an arch.
5) Weather above/erosion below –arch collapses leaving stack.
6) Further weathering and erosion eaves a stump.

Coastal Defences

Hard Engineering Defences		
Groynes	**Wood barriers prevent longshore drift, so the beach can build up.**	✓ **Beach still accessible.** ✗ **No deposition further down coast = erodes faster.**
Sea Walls	**Concrete walls break up the energy of the wave . Has a lip to stop waves going over.**	✓ **Long life span** ✓ **Protects from flooding** ✗ **Curved shape encourages erosion of beach deposits.**
Gabions or Rip Rap	**Cages of rocks/boulders absorb the waves energy, protecting the cliff behind.**	✓ **Cheap** ✓ **Local material can be used to look less strange.** ✗ **Will need replacing.**
Soft Engineering Defences		
Beach Nourishment	**Beaches built up with sand, so waves have to travel further before eroding cliffs.**	✓ **Cheap** ✓ **Beach for tourists.** ✗ **Storms = need replacing.** ✗ **Offshore dredging damages seabed.**
Managed Retreat	**Low value areas of the coast are left to flood & erode.**	✓ **Reduce flood risk** ✓ **Creates wildlife habitats.** ✗ **Compensation for land.**

Case Study: Holderness Coast

Location and Background
Located in North East England along the Yorkshire North Sea coastline from Flamborough Head to Spurn Head. It has one of the highest coastal erosion rates in Europe (2-10m per year)

Why is it Eroding?
1. **SOFT ROCK** – Coast is made of boulder clay which erodes easier
2. **DESTRUCTIVE WAVES** – Large fetch and prevailing winds mean high energy waves will erode quickly
3. **NARROW BEACHES** – Narrow beaches offer less protection
4. **PEOPLE** - Coastal defences have been built further up the coast.

Management
-Mappleton has 450m of coastline protected by rock armour costing £2m
-Sea wall and groynes at Hornsea
-Sea wall in Bridlington
CAUSES PROBLEMS DOWN THE COAST

Middle Course of a River

Here the gradient get gentler, so the water has less energy and moves more slowly. The river will begin to erode laterally making the river wider.

Water Cycle Key Terms

Precipitation	Moisture falling from clouds as rain, snow or hail.
Interception	Vegetation prevents water reaching the ground.
Surface Runoff	Water flowing over the surface of the land into rivers
Infiltration	Water absorbed into the soil from the ground.
Transpiration	Water lost through leaves of plants.

Physical and Human Causes of Flooding.

***Physical:* Prolong & heavy rainfall**
Long periods of rain causes soil to become saturated leading runoff.

***Physical:* Geology**
Impermeable rocks causes surface runoff to increase river discharge.

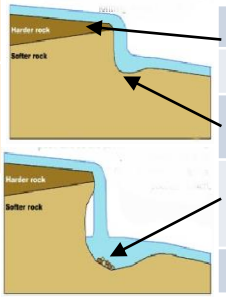
***Physical:* Relief**
Steep-sided valleys channels water to flow quickly into rivers causing greater discharge.

***Human:* Land Use**
Tarmac and concrete are impermeable. This prevents infiltration & causes surface runoff.

Upper Course of a River

Near the source, the river flows over steep gradient from the hill/mountains. This gives the river a lot of energy, so it will erode the riverbed vertically to form narrow valleys.

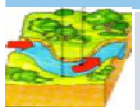
Formation of a Waterfall



1) River flows over alternative types of rocks.
2) River erodes soft rock faster creating a step.
3) Further hydraulic action and abrasion form a plunge pool beneath.
4) Hard rock above is undercut leaving cap rock which collapses providing more material for erosion.
5) Waterfall retreats leaving steep sided gorge.

Formation of Ox-bow Lakes

Step 1



Erosion of outer bank forms river cliff. Deposition inner bank forms slip off slope.

Step 2

Further hydraulic action and abrasion of outer banks, neck gets smaller.

Step 3

Erosion breaks through neck, so river takes the fastest route, redirecting flow

Step 4

Evaporation and deposition cuts off main channel leaving an oxbow lake.

Case Study – Cockermouth, 2009

Cockermouth is a small village in Cumbria. It has a permanent population of under 8000. It lies at the confluence of the Rivers Derwent and Cocker

Causes of flood – 34 hours of heavy rain (316mm in a day), Impermeable rock, steep valley sides, thin soils limit vegetation. Buildings narrowing river channel. Narrow bridges trapped debris.
Effects of flood - 1000 homes damaged.

Schools closed. Bridges collapsed. Farmland became useless. Businesses closed. Damage cost £276m.
Responses to flood - Beds of rivers lowered and channels widened. Flood gates fitted. Raised river embankments. Automatic flood walls fitted.

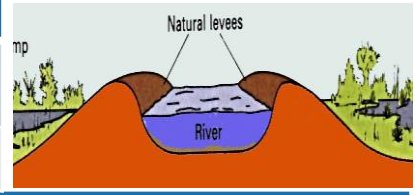
Lower Course of a River

Near the river's mouth, the river widens further and becomes flatter. Material transported is deposited.

Formation of Floodplains and levees

When a river floods, fine silt/alluvium is deposited on the valley floor. Closer to the river's banks, the heavier materials build up to form natural levees.

✓ Nutrient rich soil makes it ideal for farming.
✓ Flat land for building houses.



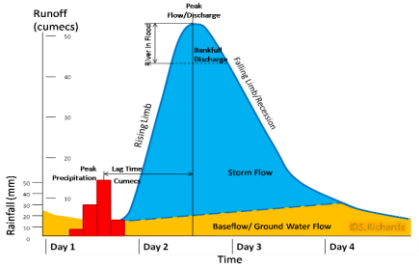
River Management Schemes

Soft Engineering	Hard Engineering
Afforestation – plant trees to soak up rainwater, reduces flood risk. **Demountable Flood Barriers** put in place when warning raised. **Managed Flooding** – naturally let areas flood, protect settlements.	**Straightening Channel** – increases velocity to remove flood water. **Artificial Levees** – heightens river so flood water is contained. **Deepening or widening river** to increase capacity for a flood.

Hydrographs and River Discharge

River discharge is the volume of water that flows in a river. Hydrographs who discharge at a certain point in a river changes over time in relation to rainfall

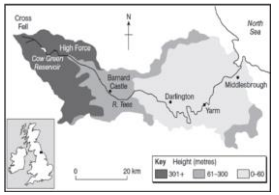
1. **Peak discharge** is the discharge in a period of time.
2. **Lag time** is the delay between peak rainfall and peak discharge.
3. **Rising limb** is the increase in river discharge.
4. **Falling limb** is the decrease in river discharge to normal level.



Case Study: The River Tees

Location and Background
Located in the North of England and flows 137km from the Pennines to the North Sea at Red Car.

Geomorphic Processes
Upper – Features include V-Shaped valley, rapids and waterfalls. Highforce Waterfall drops 21m and is made from harder Whinstone and softer limestone rocks. Gradually a gorge has been formed.
Middle – Features include meanders and ox-bow lakes. The meander near Yarm encloses the town.
Lower – Greater lateral erosion creates features such as floodplains & levees. Mudflats at the river's estuary.



Notes