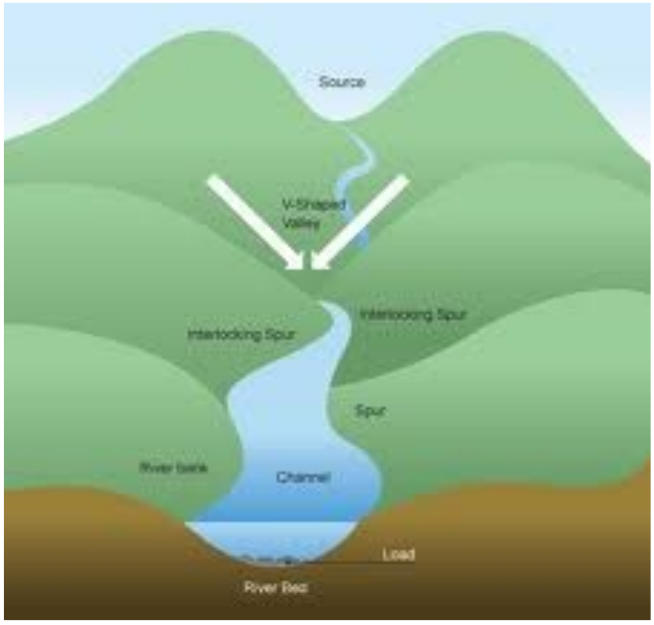
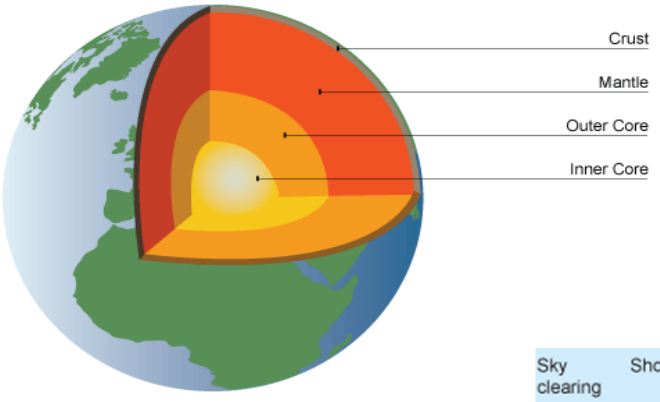
UNIT 1

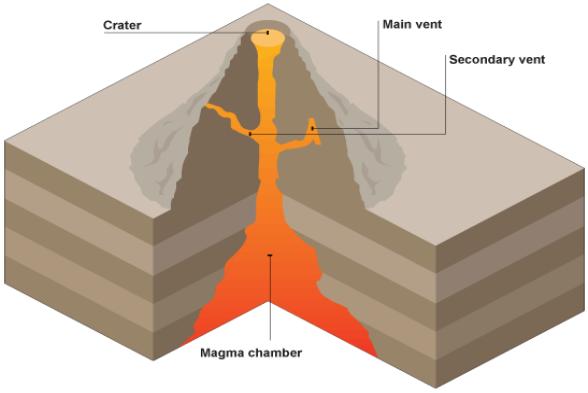
GCSE GEOGRAPHY

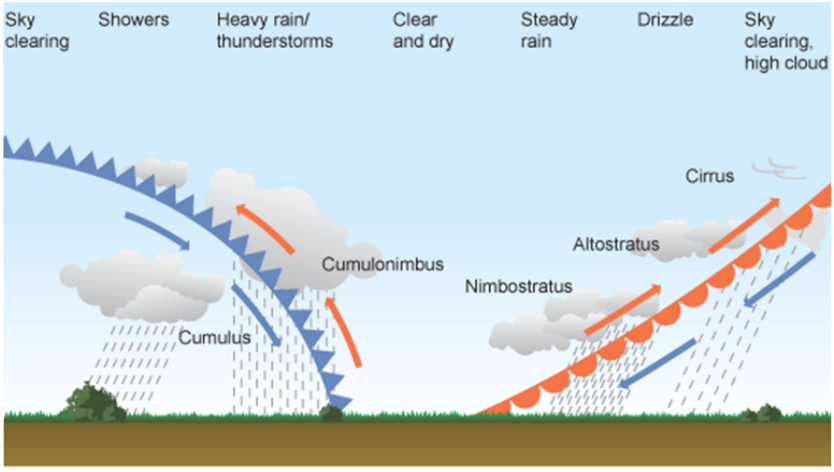
This booklet includes:

- The Restless Earth
- Challenges of Weather and Climate
- Rivers on the Land



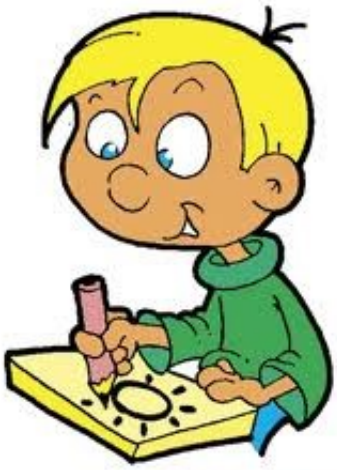






GCSE EXAM REVISION MATERIAL

How to use this Revision Guide...



WEEKS LEADING UP TO THE EXAM

1. READ through every section in the revision guide
2. LOOK at the exam tips and my predictions at the end of every section
3. HAVE A GO at answering some of the exam questions at the back of the guide
4. REMEMBER that CASE STUDIES in Geography are very important and will need a lot of revising! (The information in this booklet is only the basics, use your exercise books to revise the specifics)
5. DON'T PANIC Remember you have gone through all this information already, although you may think you have forgotten some, once you look over it a few times it will come back to you :)
6. TAKE TIME revise over a period of time which is suitable, although we all might think we work best at the last minute this is not always the case)
7. PRACTICE your time management, see if you can answer 9 mark exam questions in 10minutes!

NIGHT BEFORE/JUST BEFORE THE EXAM

1. Look over things once in the morning before the exam and once at night
2. Familiarise yourself with all your key facts
3. Enjoy a break and an early night
4. Any last minute problems, Miss Russell is in Hum3 for Form Time (come see me!)

IN THE EXAM

1. READ THE QUESTION!!! (So many times I have seen people answer questions with the EFFECTS of an event when the question is asking for the RESPONSES)
2. TAKE YOUR TIME do not rush through, make sure you have included enough detail to achieve the best possible mark
3. DRINK water (Not too much you need a wee!)
4. DON'T LOOK at other people, everyone works at their own pace (plus, it wastes time)
5. RUNNING OUT OF TIME? On a big question? Bullet Point the rest of your answer

Topic 1: The Restless Earth

Keyword	Definition
Crust	The Outer Layer of the Earth
Plate	A Section of the Earth's crust
Plate Margin	The boundary where two plates meet
Mantle	The dense, mostly solid layer between the outer core and the crust
Convection Currents	The circular currents of heat in the mantle
Subduction	The sinking of oceanic crust at a destructive margin
Collision	The meeting of two plates of continental crust. They are forced together and buckle under the pressure.
Fold Mountains	Large mountain ranges where rock layers have been crumpled as they have been forced together
Ocean Trenches	Deep sections of the ocean, usually where an oceanic plate is sinking below a continental plate
Composite Volcano	A steep-sided volcano that is made up of a variety of materials, such as lava and ash.
Shield Volcano	A broad volcano that is mostly made up of lava
Subsistence farming	Farming to provide food for the farmers own family
Terraces	Steps cut into hillside to create an area of flatland
Irrigation	Artificial watering of the land
Hydroelectric Power	The use of flowing water to turn turbines to generate electricity
Natural Hazard	An Occurrence over which people have little control, which poses a threat to people's lives and possessions. This is different from a natural event as volcanoes can erupt in unpopulated areas without being a hazard.
Primary Effects	The immediate effects of the eruption, caused directly by it.
Secondary Effects	The after-effects that occur as an indirect effect of the eruption on a longer timetable
Aid	Money, food, training and technology given by richer countries to poorer countries.
Earthquake	A sudden and often violent shift in the rocks forming the earth's crust, which is felt at the surface.
Immediate responses	How people react as the disaster happens and the immediate aftermath
Long-Term Responses	Later reactions that occur in the weeks, months and years after the event.
Vent	The opening- usually central and single- in a volcano, from which magma is emitted.
Lahar	These secondary effects of a volcanic eruption are mudflows resulting from ash mixing with melting ice or water.
Supervolcano	A mega colossal volcano that erupts at least 1,000km3 of material
Caldera	The depression of the Supervolcano marking the collapsed magma chamber
Fissures	Extended openings along a line of weakness that allows magma to escape
Geothermal	Water that is heated beneath the ground, which water erupts into the air under pressure.
Geyser	A geothermal feature in which water erupts into the air under pressure
Hotspot	A section of the earth's crust where plumes of magma rise, weakening the crust. These are away from plate boundaries.

Keyword	Definition
Earthquake	A sudden and brief period of intense ground shaking
Focus	The point in the Earth's crust where the earthquake originates
Richter Scale	A logarithmic scale used for measuring earthquakes, based on scientific recordings of the amount of movement
Epicentre	The point at the earth's surface directly above the focus
Shockwaves	Seismic waves generated by an earthquake that pass through the earth's crust
Mercalli Scale	A means of measuring earthquakes by describing and comparing the damage done, on a scale of I to XII
Debt	Money owed to others, to a bank or to a global organisation such as the World Bank
The three P's	Prediction, protection and preparation
Prediction	Attempts to forecast an event based on current knowledge
Protection	Constructing buildings which will not collapse
Preparation	Organising activities or drills so that people know what to do in the event of an earthquake
Tsunami	A special type of wave where the entire depth of the sea or ocean is set in motion by an earthquake, which displaces the water above it and creates a huge wave

EXAM TIPS FOR A RESTLESS EARTH

Getting that Make sure you know the definitions for the keywords (not word for word) just make sure you understand what they mean!

Tip: Try to use keywords in all exam answers 3 marks + as it will help you to shorten your answer and show the examiner you have an extensive knowledge of the topic.

Tip: When answering CASE STUDY questions always include at least 3 specific facts about that event. **E.g**. During the 2004 Indian Ocean Tsunami the effects included; around **300,000 people were killed, 2 million people made homeless and many countries including Somalia were hit by the wave.**

Getting that When answering CASE STUDY questions always include at least 1 specific fact about that event. **E.g**. During the 2004 Indian Ocean Tsunami around **300,000 people were killed**

Getting that: Practice drawing the diagrams you are unsure of, make sure you have all the key labels included.

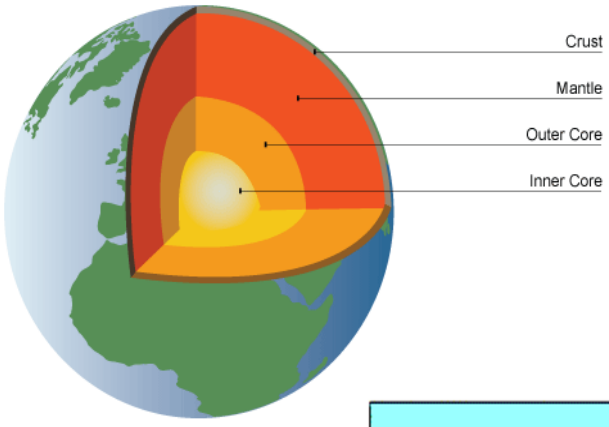
Tip: It is very important to correctly label your diagrams when asked to draw one. It is these rather than your artistic capabilities which will be tested.

REMEMBER: Revision is about picking out key information and re-visiting it. If there is something you completely DO NOT UNDERSTAND please ask your teacher to go through it again.

Restless Earth: The Basics

The structure of the Earth

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. With its immense heat energy, the inner core is like the engine room of the Earth.
2. **The outer core** is the layer surrounding the inner core. It is a liquid layer, also made up of iron and nickel. It is still extremely hot, with temperatures similar to the inner core.
3. **The mantle** is the widest section of the Earth. It has a diameter of approximately 2,900 km. The mantle is made up of semi-molten rock called magma. In the upper parts of the mantle the rock is hard, but lower down the rock is soft and beginning to melt.
4. **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.



There are two types of Crust:
The Earth's crust is made up of:

- **Oceanic Crust**– Plates which carry sea or ocean
- **Continental Crust**– Plates which carry land masses or continents.

The Location of the world's Plates and Plate Margins.

This map will help you identify key areas for volcanic and earthquake activity.

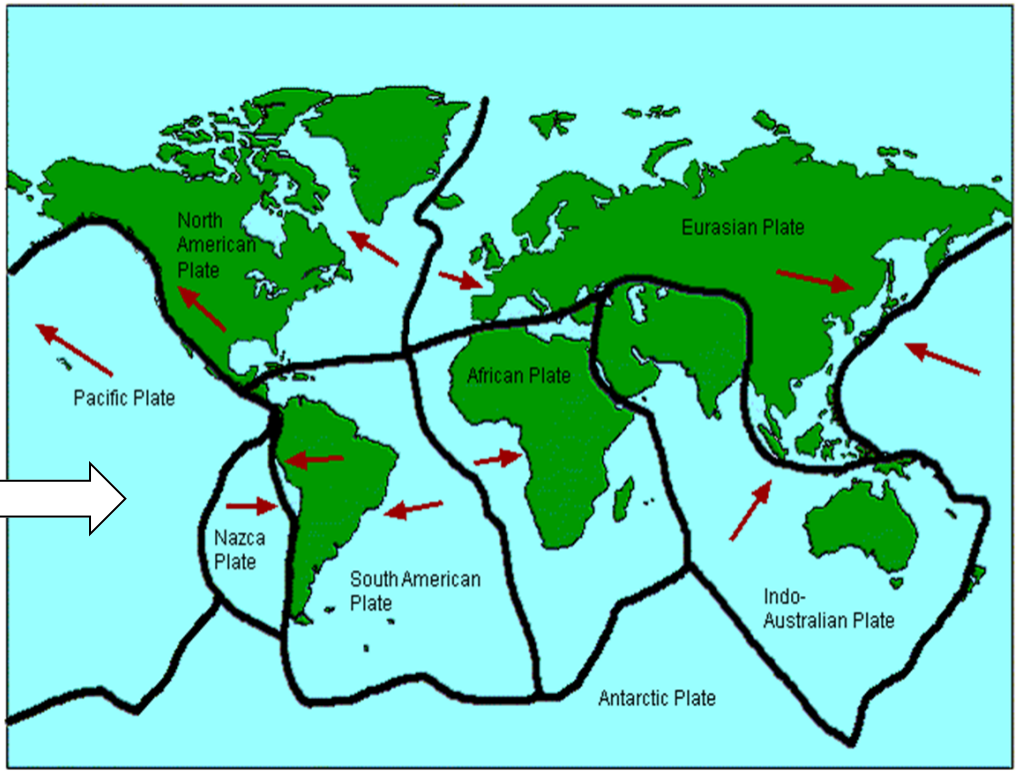
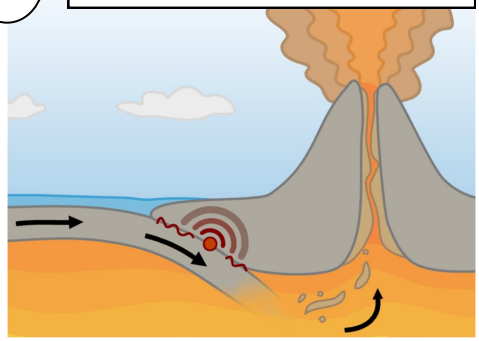


Plate Margins/Boundaries

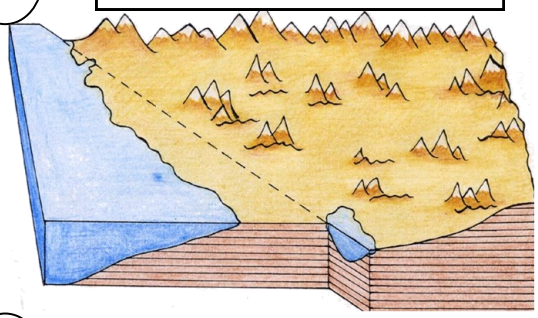
1 DESTRUCTIVE



At Destructive Plates:

- Two Plates meet (An Oceanic and a Continental)
- The Oceanic plate is heavier and sinks below the Continental Plate. This is called SUBDUCTION
- The Oceanic Plate then melts and the magma formed rises through the continental crust to form a volcano.
- The Andes is formed along a destructive margin

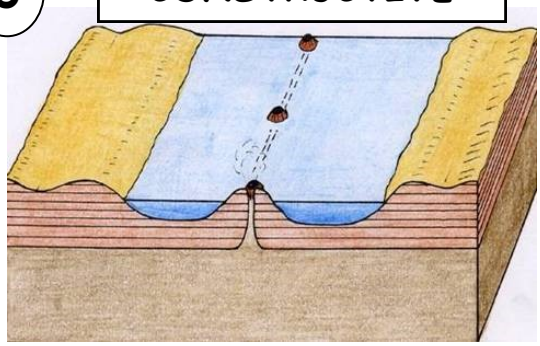
2 CONSERVATIVE



At Conservative Plates:

- Two Plates move past each other
- FRICTION between the plates causes earthquakes
- The San Andreas Fault is a famous example of a conservative plate boundary

3 CONSTRUCTIVE



At Constructive Plates:

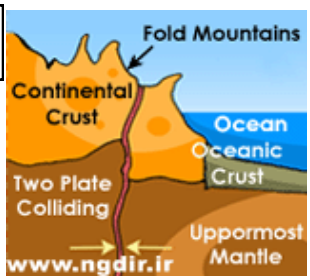
- Two Plates move apart from each other (Both Oceanic Plates)
- Magma rises through the centre
- Creates a gentle sloped SHIELD VOLCANO
- The Mid-Atlantic ridge is an example of a constructive plate boundary

KEY VOCABULARY

Destructive Plate Boundary
Constructive Plate Boundary
Conservative Plate Boundary
Inner core
Outer Core
Mantle
Crust
Subduction

Landforms @ Plate Margins

1. FOLD MOUNTAINS

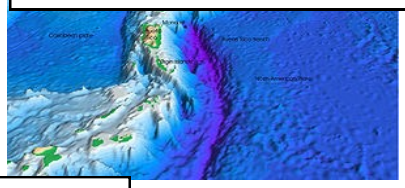


Fold mountains are mountains formed mainly by the effects of folding on layers within the upper part of the Earth's crust

Fold mountains are formed when two tectonic plates move together (a compressional plate margin). This can be where two continental plates move towards each other or a continental and an oceanic plate. The movement of the two plates forces sedimentary rocks upwards into a series of folds

2. OCEAN TRENCHES

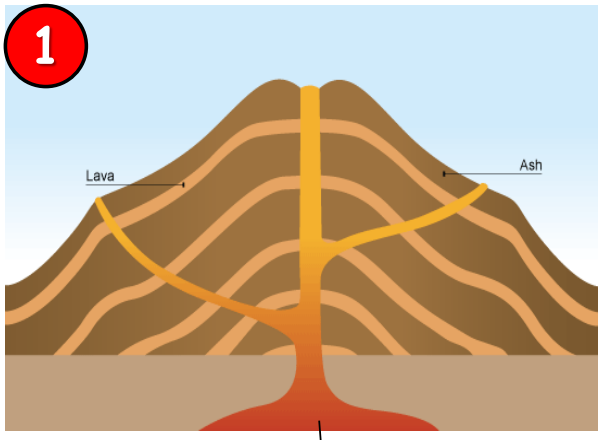
Ocean trenches are the deepest part of the sea floor and are formed at the Subduction zone



3. VOLCANOES

Composite Volcano

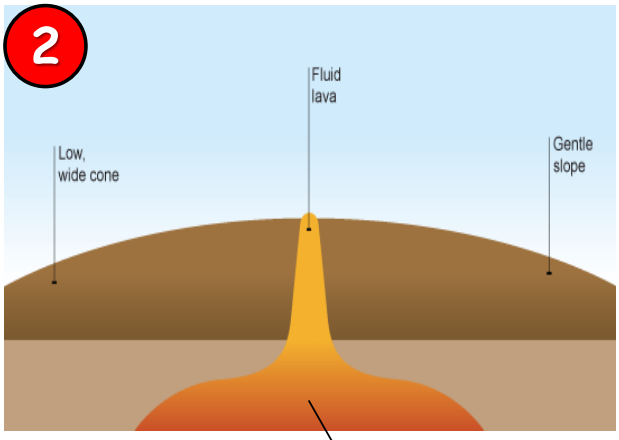
Eruptions from this volcano are infrequent but often violent



Magma Chamber

Shield Volcano

Eruptions from this volcano are frequent and non-violent



Magma Chamber

3. HYDROELECTRIC POWER

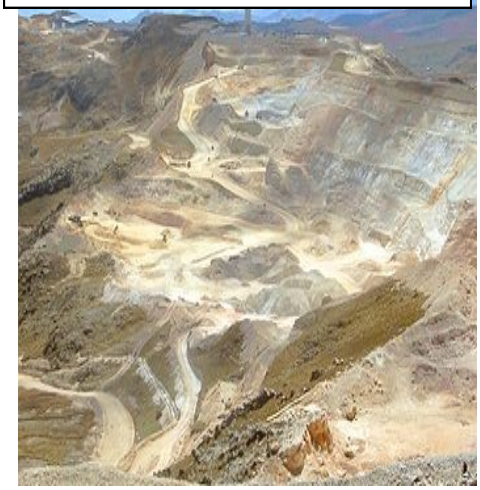
Positive Impacts:
Provides energy for many of the local areas
Negative Impacts:
Eyesore and area it is built requires to be flooded every year

Hydroelectric Power (HEP)

The deep valley and rivers of the Andes give it huge potential as a region to produce hydroelectric power. The narrow valleys are ideal to dam as it cuts costs, and the steep relief increases water velocities allowing electricity generation. Snow melt fuels most of the water provision, but this means that HEP production can be reduced to small amounts in winter.

The **Yuncan dam project** dams the Puacartambo and Huachon rivers in northeast Peru, while the el Platinal project will begin construction in 2009

4. MINING



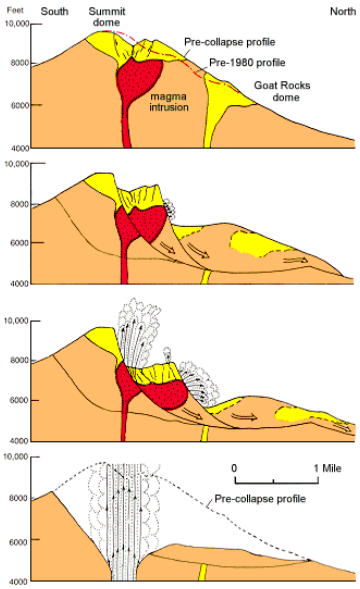
Positive Impacts:
Provides jobs for the local people and money for the Peruvian economy
Negative Impacts:
Eyesore and adds to traffic into the area with the large lorries needed for transporting material

Mining

The Andes mountains contains a rich mix of minable materials that are both very valuable and very useful to man. When the Spanish conquered South America their prime objective was to prospect for gold. Potosi in Bolivia was one of Spain's principle mines and produced lots of silver. There exist large deposits of Coal, oil and natural gas, iron ore, gold, silver, tin, copper, phosphates and nitrates and Bauxite (for aluminium) within the Andes mountains. **The Yanacocha gold mine in Peru** is the largest gold mine in the world. It is an open cast mine and the rocks containing the gold are blasted with dynamite. The rock is then sprayed with toxic cyanide and the gold extracted from the resulting solution. This can contaminate water supplies. The nearby town of Cajamarca has grown from 30,000 when the mine started to 240,000 people in 2005.

Mount St Helens Case Study Volcano

How it happened!



April May 1980

A bulge was growing on the north flank.

May 18th at 8.32 a.m.

An earthquake occurs under the volcano and triggers a huge landslide.

May 18th at 8.33 a.m.

With the pressure released a huge lateral blast heads northwards

May 18th rest of the day

More and more ash shoots up high into the atmosphere. It gradually blows around the world.

EFFECTS OF THE ERUPTION

Up to 70mm of ash falls across Washington and East Montana… 7000 school students have an early summer vacation due to problems on the roads

Hot mudflows raise the temperature of the rivers and lakes to 30°C

Mudflows block and divert rivers. The US army takes 18 months to dig out the debris from the River Toutle.

Two million birds, animals and fish are killed.

Communications routes threatened - railway and road bridges destroyed, Portland harbour blocked

An increase in tourism

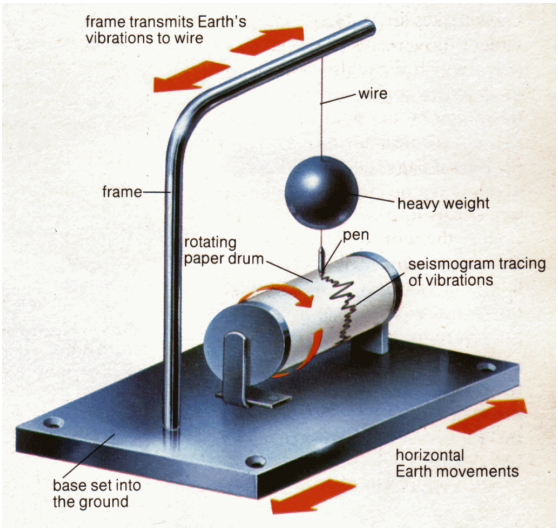
60 people die from the eruption.

Deer mice, chipmunk, vole, gophers, salamander survive the blast. Their population steadily increases due to the absence of predators.

Gophers, through their tunnelling, mix the soil with the ash. This increases the fertility of the soil.

Damage to crops=$175million

Predicting and Monitoring Volcanoes



Prediction

Time lapse cameras in the crater allow geologists to make safe observations

Seismograms indicate what to look out for. They measure vibrations in the earths crust and measure the magnitude of earthquakes.

Tiltmeters detect a change in slope caused by shifting magma beneath the surface

GPS use satellites to detect minute movements over a larger area.

http://www.bbc.co.uk/schools/gcsebitesize/geography/natural_hazards/managing_hazards_video.shtml

Preparing for an Eruption

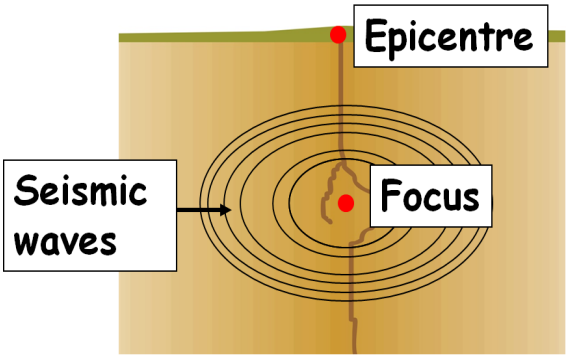
A detailed plan is needed for dealing with a possible eruption. Everyone who could be affected needs to know the plan and what they should do if it needs to be put into action. Planning for a volcanic eruption includes:

- creating an ***exclusion zone*** around the volcano
- being ready and able to ***evacuate*** residents
- having an emergency supply of ***basic provisions***, such as food
- funds need to be available to deal with the emergency and a good ***communication system*** needs to be in place

Earthquakes

KEY TERMS

Focus	is the point at which the rock moves. The seismic waves start at the focus.
Epicentre	is directly above the focus on the Earth's surface.



Why do Earthquakes happen?

The two plates at a plate margin cannot move past each other easily. The two plates become locked. Friction causes pressure to build up. Suddenly, the pressure is released and the plates jolt into a new position. This causes **seismic waves**. The vibrations they cause are called an **earthquake**

How are Earthquakes measured?

The Richter Scale This measures the magnitude of a tremor (how powerful it is) using an instrument called a **seismograph**.The Richter Scale is measured on a scale from 1 to 10. It is a logarithmic scale which means that a size '6' on the Richter Scale is 10 times more powerful than a size '5' and 100 times more powerful than a size '4'.

Mercalli Scale. This measures the destruction caused by an earthquake and is measured in Roman Numerals I to XII (1-12)

THE THREE P'S!

Remember when talking about the responses to earthquakes:

- **Predict** (using scientific equipment e.g. seismometers etc...)
- **Protect** (Make buildings earthquake-proof- rubber foundations etc...)
- **Prepare** (Earthquake drills etc...)

Earthquakes Case Studies

KOBE EARTHQUAKE (1995)

WHERE?:
JAPAN (RICH COUNTRY- MEDC)

WHY?: At 5.46am on 17th January 1995, the Philippines plate shifted beneath the Eurasian plate along the Nojima fault line that runs beneath Kobe. **7.2 ON RICHTER SCALE**

PRIMARY EFFECTS: Damage to buildings. Many older buildings collapsed completely. 300,000 homeless, 6,434 people killed (4,600 of them Kobe residents). Seriously injured over 40,000.

SECONDARY EFFECTS: The most devastating secondary effect was fire. Paraffin heaters and gas cookers set fire to buildings, Damage = $220billion!, 30% of roads usable

RESPONSES: Friends and neighbours searched through rubble for survivors joined by the emergency services when access was possible Railways were 80% operational within one month. Road network was fully restored by July 1995
The Japanese practice an earthquake drill every year to prepare them

SICHUAN EARTHQUAKE (2008)

WHERE?:
CHINA (POOR COUNTRY- LEDC)

WHY?: **On 12th May 2008** at 2.28pm, the pressure resulting from the Indian Plate colliding with the Eurasian Plate was released. This led to an earthquake of **7.9 ON RICHTER SCALE**

PRIMARY EFFECTS: Damage to buildings (80% of buildings collapsed in Beichuan). 5 million people were homeless, 69,000 people killed (18,000 missing). Seriously injured over 374,000. Poor Housing materials blamed.

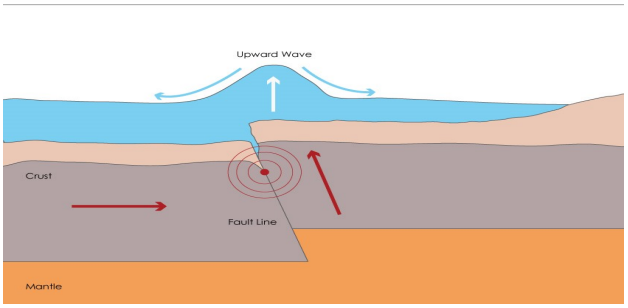
SECONDARY EFFECTS:
Communications were brought to a halt. Neither land nor mobile phones worked in Wenchuan. Roads were completely blocked by landslides. Damage = $75 MILLION

RESPONSES: Troops parachuted in to assess the situation in remote areas. Others hiked on foot. On 14th May China requested international help. Cash donations were the preferred option. The Chinese government pledged $10million rebuilding fund and wrote off debts owed by survivors

Tsunami's

KEY TERMS

Tsunami	A special type of wave where the entire depth of the ocean is set in motion by an event, often an earthquake, which displaces the water above it and creates a huge wave



What causes a tsunami?

- When an earthquake, volcano or landslide happens on the ocean floor, water is displaced. This water forms the start of the tsunami.
- When the waves reach shallower water:
- their height can increase by several metres
- the shallow water slows the wave
- the waves get closer together

CASE STUDY: INDIAN OCEAN TSUNAMI (BOXING DAY 2004)

Two tectonic plates, the **Australian** and **Eurasian plates**, meet just off Sumatra's south-west coast, grinding together and sending periodic seismic tremors through the region. At **0059 GMT** a violent rupture occurred on the sea floor along a fault about **1,000km long**.

EFFECTS: 230,210 - 310,000 deaths, Two million people were made homeless. People were swept away in the waters, which arrived rapidly and with little warning. Thirteen countries were affected, the worst being Indonesia. Indonesia was hit by the tsunami first. Forty-five minutes later the tsunami reached Thailand. Islands reliant on tourism and fishing, such as the Maldives, had to rebuild their industries

RESPONSES: Short-term aid, such as water purification tablets, temporary housing and medical supplies were given from international countries.

An early warning system between countries surrounding the Indian Ocean has been set up.

Hurricanes

KEY TERMS

Hurricane	A powerful tropical storm with sustained winds of over 75mph.
Eye	The centre of the hurricane where sinking air creates clear conditions
Eye Wall	A high bank of cloud either side of the eye where the wind speeds are high and heavy rain falls
Track	The path/course of a hurricane

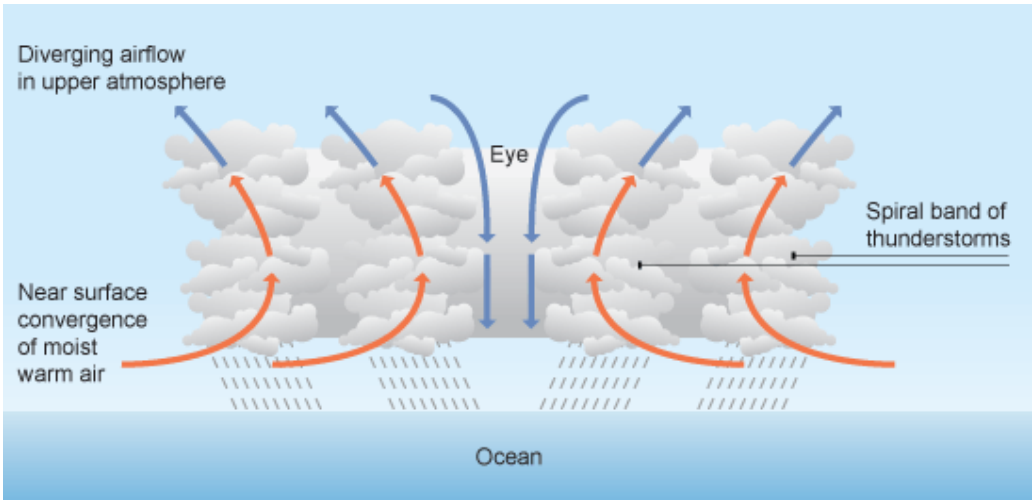


Diagram of a Hurricane.

Hurricanes need a lot of heat to form and a sea surface temperature of at least 26°C, which is why they usually occur over tropical seas. They also need to be between 5 and 20° north or south of the equator. It works like this:

1. When this warm and wet air rises, it condenses to form towering clouds, heavy rainfall.
2. Rising warm air causes the pressure to decrease at higher altitudes. Warm air is under a higher pressure than cold air, so moves towards the 'space' occupied by the colder, lower pressure, air. So the low pressure 'sucks in' air from the warm surroundings, which then also rises.
3. Air that surrounds the low pressure zone at the centre flows in a spiral at very high speeds - anti -clockwise in the northern hemisphere - at speeds of around 120 km/h (75 mph).
4. Air is ejected at the top of the storm – which can be 15km high – and falls to the outside of the storm, out and over the top, away from the eye of the storm. As this happens, it reduces the mass of air over the 'eye of the storm' - causing the wind speed to increase further.
5. The faster the winds blow, the lower the air pressure in the centre, and so the cycle continues. The hurricane grows stronger and stronger.
6. The cloud brings heavy rain, thunder and lightning.
7. In the centre is the **eye of the hurricane**, about 45 km across (30 miles) across. Often there will be no clouds in the eye.
8. In the northern hemisphere, the prevailing easterly tropical winds tend to steer hurricanes toward land - although their course is unpredictable. As hurricanes move inshore, their power gradually reduces because their energy comes from sucking up moist sea air.

Comparing Two Hurricanes

HURRICANE KATRINA (2005)	CYCLONE NARGIS (2008)
WHERE? North America– New Orleans 6th most powerful hurricane **EFFECTS?** 1,836 dead Hundreds of thousands homeless 3 million left without electricity $89billion—COST Help arrived in a few hours **RESPONSES:** **SHORT-TERM**: Rescuing people from floodwater, treating injured **LONG-TERM**: Rebuilding New Orleans **WARNINGS**: Katrina had been monitored and predicted accurately 80% people evacuated	**WHERE?** MyanMar (Burma) Developed in Bay of Bengal **EFFECTS?** At least 140,000 dead 2-3 million homeless UN estimate 1.5 million affected $10billion– COST Government refused foreign aid **RESPONSES:** **SHORT-TERM**: Identification and burial of the dead, Treating the injured **LONG-TERM**: Rebuilding homes, Reclaiming Farmland **WARNINGS**: Most people had no idea the cyclone was approaching

Topic 3: Water on the Land

RIVERS KEYWORDS GLOSSARY

Cross profiles of river valleys – V-shaped sections, changing downstream from steep to gentle

Discharge – amount of water in a river at any one time

Erosion processes – wearing away the land surface by hydraulic action, abrasion, attrition and solution

Flood plain – flat land built of silt on the sides of a river, usually in its lower course

Flooding – water covering land that is normally dry after a river bursts its banks

Gorge – steep narrow valley, with rocky sides

Hard engineering strategies – strong construction methods to hold floodwater back or keep it out

Hydraulic power – erosion of rocks by the force of moving water in waves

Levée – raised bank along the sides of a river, made of silt from river floods

Long profile of a river – a summary of the shape and gradient of a river bed from source to mouth

Management of problems – making changes for improvement, planning ahead to stop them occurring in the future

Management strategies – ways to control development and change, to preserve and conserve, and to plan for a sustainable future

Meander – bend in a river, usually along its middle or lower course

Ox-bow lake – semi-circular lake on the flood plain of a river, a cut-off meander

Precipitation – all moisture that reaches the Earth's surface from the atmosphere

Soft engineering strategies – more natural ways to reduce the impact of flooding on humans, with less intervention and more preparation

Soil erosion – loss of fertile topsoil by action of wind and water

Sustainable management – planning ahead and controlling development for a long future

Transportation processes – movement of sediment by traction, saltation, suspension and solution

Processes of Erosion	
Corrosion (Solution)	Material dissolved by the river
Abrasion (Corrasion)	Load wears away river channel
Hydraulic Action	Force of current dislodges loose material
Attrition	Load collides
Processes of Transportation	
Traction	Rolling of large load
Saltation	Bouncing of smaller load
Suspension	Fine material held within the water
Solution	Rocks dissolved within the water

EXAM TIPS FOR WATER ON THE LAND

Getting that To achieve a high score on a levelled questions (one worth 4 marks or more) you will need to need to include keywords in your answer.

Tip: When a landform question has the 'explain' command term you need to identify the main processes of change and link these to landform development.

Tip: The command term 'outline' requires you to '*give the main points*'. Although this usually involves a list of statements, try to avoid bullet-points. On 'outline' questions you will be rewarded for including extending statement.

Plus: ALWAYS 3 Specific facts in CASE STUDIES

Getting that : When answering CASE STUDY questions always include at least **1** specific fact about that event. **E.g**. During the 2004 Boscastle Flash Flood around **58 buildings were flooded and most had to be demolished**

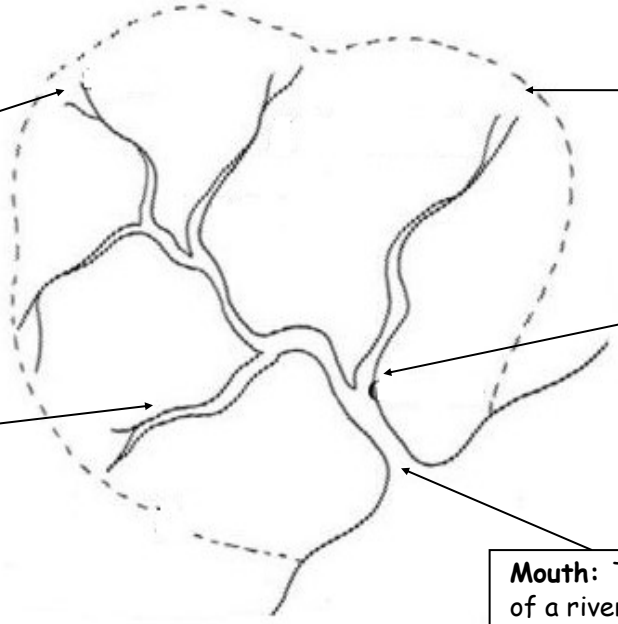
Getting that: Take care with spelling and grammar. Literacy is becoming a more important element of the exam process. Careless spelling errors could cost you important points.

ip: Always read questions carefully and pay particular attention to command terms. A describe question requires extending statements for full marks. Check spelling also.

REMEMBER: Revision is about picking out key information and re-visiting it. If there is something you completely DO NOT UNDERSTAND please ask your teacher to go through it again.

Water on the Land: The Basics

RIVER DRAINAGE BASIN



Source: Where a river starts.

Watershed: The boundary between two drainage basins

Confluence: The point where two rivers join.

Tributary: A smaller river that flows into the main channel.

Mouth: The end of a river.

Key Point

Rivers are channels of water which drain the land's surface. They erode, transport and deposit materials, creating steep valleys and wide floodplains.

RIVER LONG PROFILE

Source	Middle	Mouth
Large / Angular Bedrock	Eroded bedrock – smoother and smaller	Bedrock eroded into fine silt and sand

Narrow / Shallow channel Flow slowed by friction	Channel wider and deeper Less friction so faster flow	Deep and wide channel Little friction resulting in a fast flow

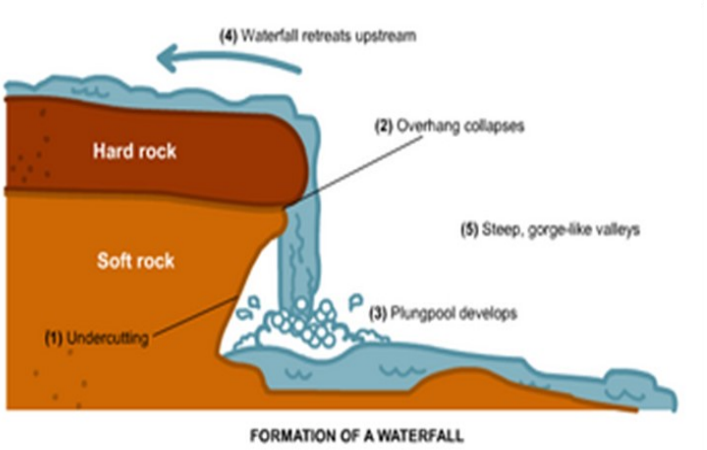
Key Point

A River Long Profile is usually shown as a sloping curve like this ->

RIVER LANDFORMS

RIVER LANFORMS RESULTING FROM EROSION

WATERFALL

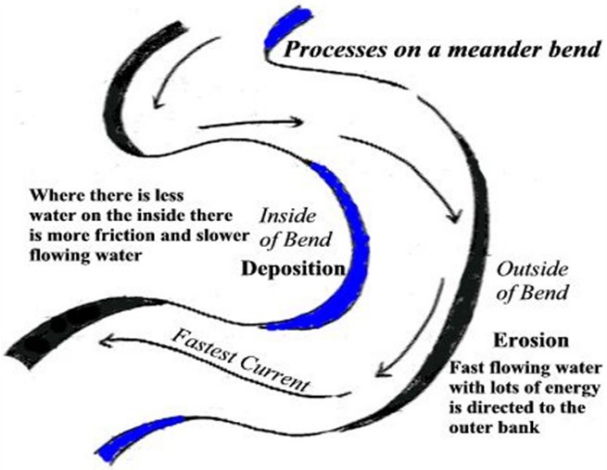


FORMATION OF A WATERFALL

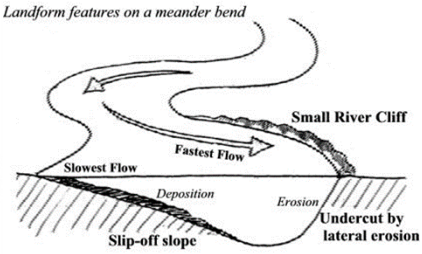
1. Waterfalls are formed where the river flows from **harder rock** onto **softer rock**
2. The weaker, softer rock is eroded by **abrasion** and **hydraulic action**, undercutting the hard rock whilst deepening the **plunge pool**.
3. Eventually the over hanging hard rock will collapse due to a lack of support, causing the waterfall to move back.
4. This process has happens again and again, as the waterfall retreats upstream a steep rocky valley is created, known as a **gorge**.

RIVER LANFORMS RESULTING FROM EROSION AND DEPOSITION

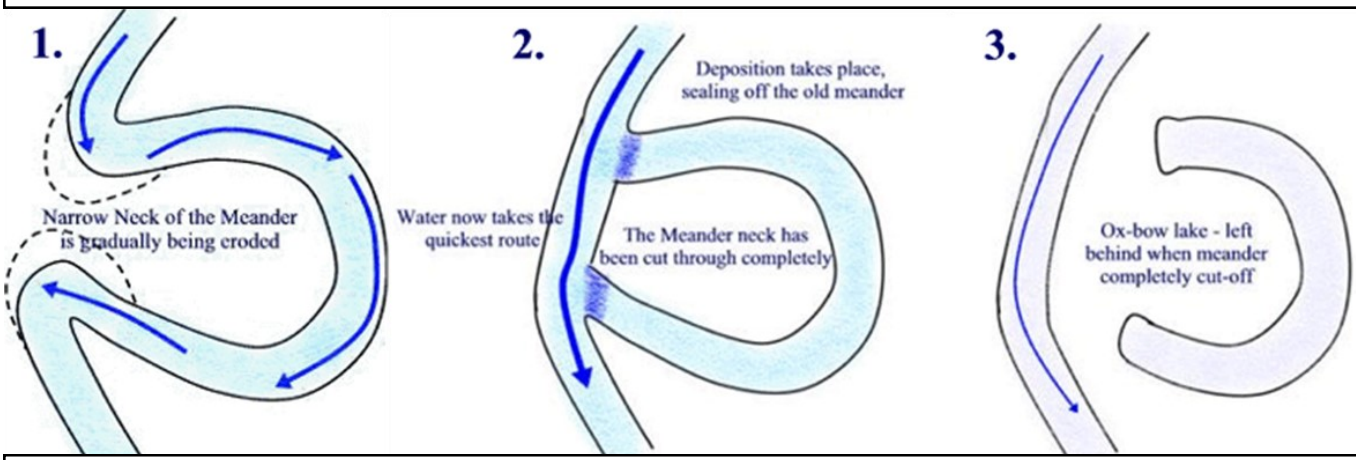
MEANDER



1. As the river erodes laterally, to the right side then the left side, it forms large bends, and then horseshoe-like loops called **meanders**.
2. The formation of meanders is due to both deposition and erosion and meanders gradually migrate downstream.
3. The force of the water **erodes** and undercuts the river bank on the **outside** of the bend where water flow has most energy due to decreased friction.
4. On the **inside** of the bend, where the river flow is slower, material is **deposited**, as there is more friction.



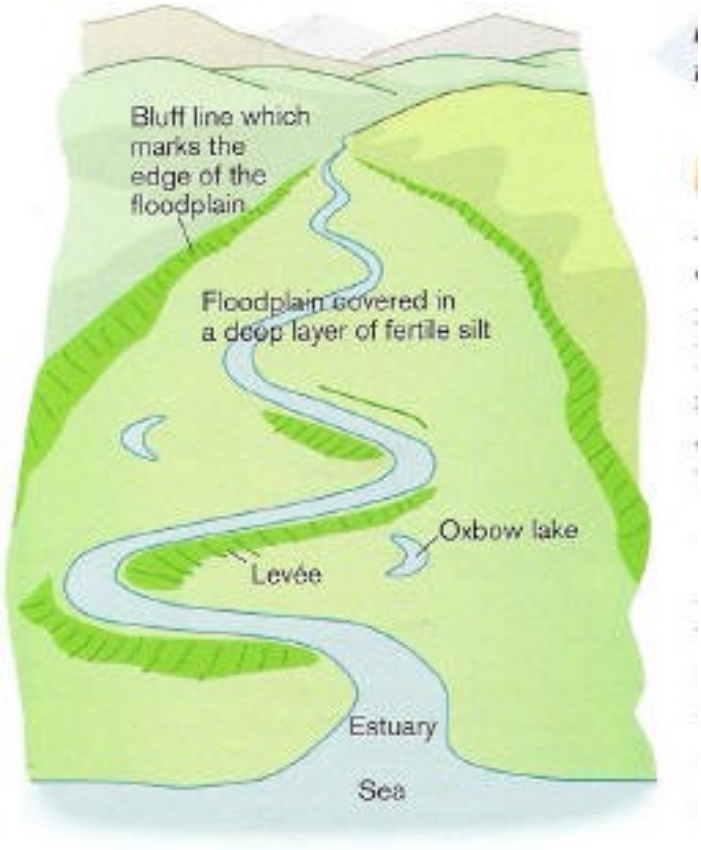
OX-BOW LAKE



form when meanders loop back on themselves (forming an almost closed curve). Erosion cuts through the narrow meander neck whilst deposition blocks off the entrance to the old meander, separating the ox-bow lake from the river.

RIVER LANFORMS RESULTING FROM DEPOSITION

FLOODPLAINS AND LEVEES



FLOODPLAIN
In a river's middle course lateral erosion causes the river's meanders to migrate. As the river erodes and deposits is creates an area of flat land, known as a floodplain. When a river floods, water inundates this flat area and deposits a covering of silt. Over time thick layers of silt can build-up leading to the creation of alluvium soil. As the river moves towards its mouth, it meanders more and more and the floodplain becomes larger and larger.

LEVEES
form during times of flood. As the river leaves its channel there is a sudden loss of energy, resulting in the river depositing much of its load immediately next to the main channel. Overtime this deposition builds up creating a natural embankment called a levee.

MODEL EXAM ANSWERS

Exam Question: Explain the formation of ox-bow lakes (6 marks).

Grade C Response

Where two meanders migrate towards each other they eventually create a narrow piece of land called a neck. The river erodes through the neck creating a new straight route. The old bend is called an oxbow lake.

Level 2 – 4 marks. Response lacks geographical terms and is incomplete, failing to explain how the old meander bend becomes separated from the river.

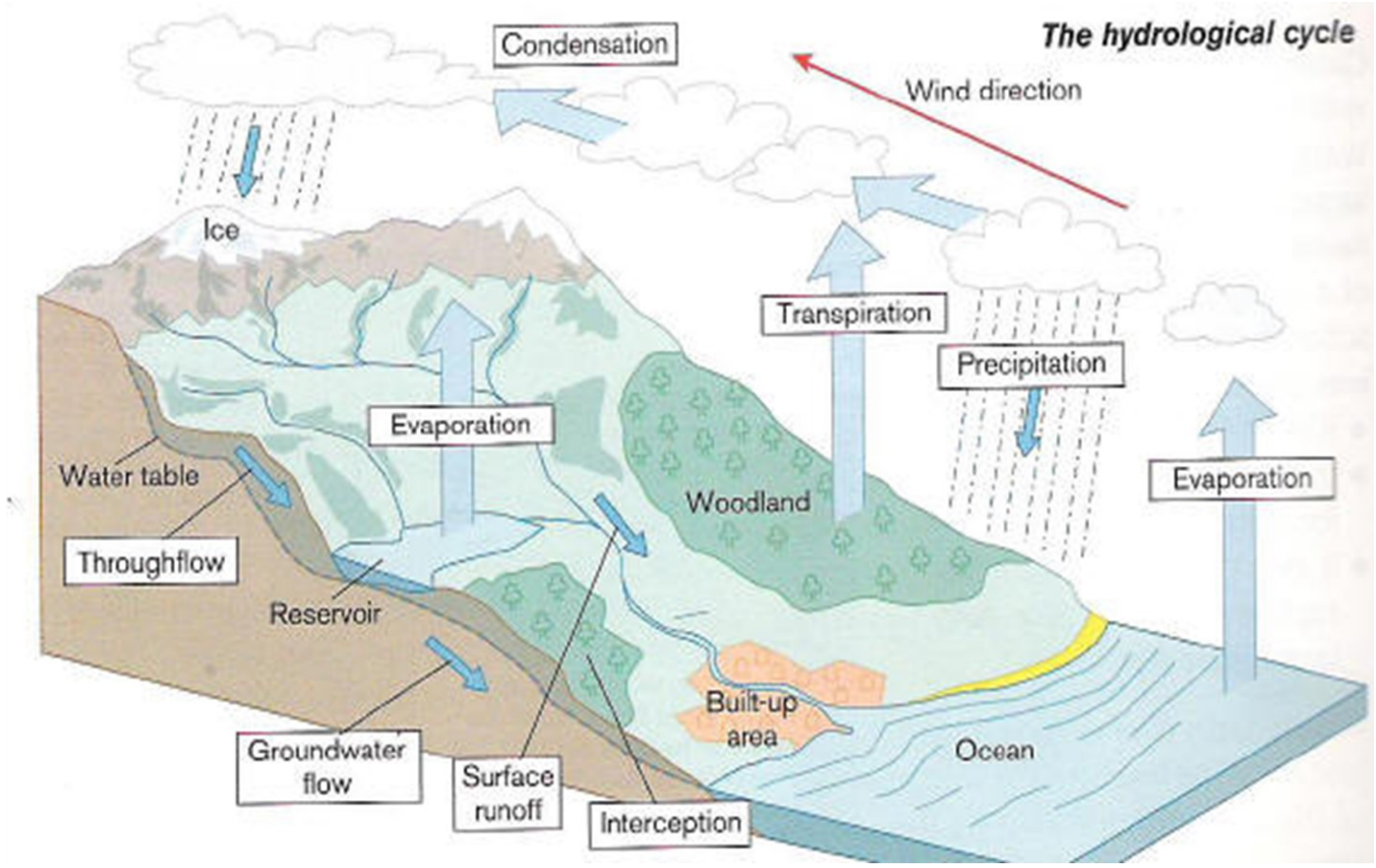
Exam Question: Explain the formation of ox-bow lakes (6 marks).

Grade A Response

Due to erosion (abrasion) on the outside and deposition on the inside, meanders migrate over their floodplain. In places they migrate towards each other, forming a meander neck. The neck is eventually eroded creating a faster, straighter route for the river. As little water now flows around the loop, deposition blocks off the old bend, forming a oxbow lake.

Level 3 – 6 marks. Refers to the entire process and includes a number of subject specific terms.

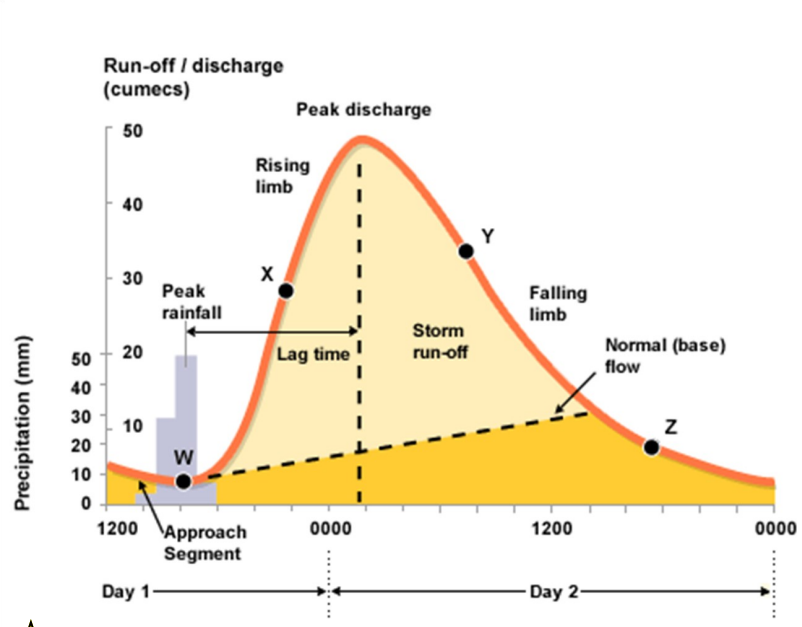
River Hydrological Cycle



KEYWORD	DEFINITION
PRECIPITATION	ANY SOURCE OF MOISTURE REACHING THE GROUND
INTERCEPTION	WATER BEING PREVENTED FROM REACHING THE SURFACE BY TREES
SURFACE STORAGE	WATER HELD ON THE GROUND SURFACE
INFILTRATION	WATER SINKING INTO SOIL/ROCK FROM THE GROUND SURFACE
SOIL MOISTURE	WATER HELD IN THE SOIL LAYER
PERCOLATION	WATER SEPING DEEPER BELOW THE SURFACE
GROUNDWATER	WATER STORED IN THE ROCK
TRANSPIRATION	WATER LOST THROUGH PORES IN VEGETATION
EVAPORATION	WATER LOST FROM GROUND/VEGETATION SURFACE
SURFACE RUN-OFF	WATER FLOWING ON TOP OF THE GROUND
THROUGHFLOW	WATER FLOWING THROUGH THE SOIL LAYER PARALLEL TO THE SURFACE
GROUNDWATER FLOW	WATER FLOWING THROUGH THE ROCK LAYER PARALLEL TO THE SURFACE
WATER TABLE	CURRENT UPPER LEVEL OF SATURATED ROCK/SOIL WHERE NO MORE WATER CAN BE ABSORBED

Storm Hydrograph

STORM HYDROGRAPH



The **peak rainfall** is the time of highest rainfall. The **peak discharge** (the time when the river reaches its highest flow) is later because it takes time for the water to find its way to the river (**lag time**) . The normal (**base**) flow of the river starts to rise (**rising limb**) when run-off, ground and soil water reaches the river. Rock type, vegetation, slope and situation (ie is this an urban river?) affect the steepness of this limb. The **falling limb** shows that water is still reaching the river but in decreasing amounts. The run-off/discharge of the river is measured in cumecs - this stands for cubic metres per second. Precipitation is measured in mm - this stands for millimetres.

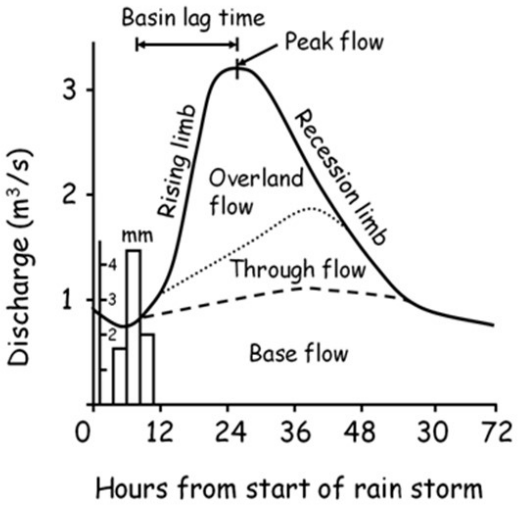
EXAM TIP

You are expected to be able to construct, describe and explain hydrographs. A hydrograph shows two graphs - rainfall (in bars) and discharge (in a line).

FACTORS AFFECTING RIVER DISCHARGE

FACTOR	EXPLANATION
RELIEF	THE STEEPNESS OF THE LAND AFFECTS HOW QUICKLY WATER CAN REACH THE RIVER CHANNEL. (FASTER FLOW- STEEPER LAND)
TEMPERATURE	AFFECTS THE LOSS OF WATER FROM THE DRAINAGE BASIN AND THEREFORE THE LEVEL OF DISCHARGE. WHEN TEMPERATURES ARE HIGHER THERE IS GREATER LOSS VIA EVAPORATION.
IMPERMEABLE ROCK	IMPERMEABLE SURFACES DO NOT ALLOW WATER TO INFILTRATE THEREFORE THERE IS GREATER SURFACE RUN-OFF
DEFORESTATION	IF TREES ARE REMOVED, WATER REACHES THE SURFACE FASTER AND THE TREES ARE NOT INTERCEPTING OR TAKING WATER FROM THE GROUND.
URBANISATION	EXPANDING TOWNS CREATE AN IMPERMEABLE SURFACE. THIS IS MADE EVEN WORSE BY BUILDING DRAINS TO TAKE THE WATER AWAY FROM BUILDINGS QUICKLY- AND QUICKLY INTO THE RIVERS!

STORM HYDROGRAPH



KEYWORDS	
DISCHARGE	The volume of water passing a given point in a river at any moment in time
STORM/FLOOD HYDROGRAPH	A Line graph drawn to show the discharge in a river in the aftermath of a period of rain
FLASHY	A hydrograph that responds quickly to a period of rain so that it characteristically has a high peak and a short lag time.

Factors influencing Storm Hydrographs

Area, Shape, Slope, Rock Type, Soil, Land Use, Drainage Density, Precipitation, Temperature, Tidal Conditions

Hydrograph

Record of River Discharge over a period of time

River Discharge

= cross sectional area X rivers mean (average) velocity

(at a particular point in its course)

Storm Hydrographs

Show the change in discharge caused by a period of rainfall

Rising limb: The rising limb of hydrograph reflects a prolonged increase in discharge from a catchment area, typically in response to a rainfall event

Recession limb: It represents the withdrawal of water from the storage built up in the basin during the earlier phases of the hydrograph.

Peak discharge: the highest point on the hydrograph when the rate of discharge is greatest

Lag time: the time interval from the centre of mass of rainfall excess to the peak of the resulting hydrograph.

Time to peak: time interval from the start of the resulting hydrograph.

Discharge: the rate of flow (volume per unit time) passing a specific location in a river or other channel

Top AQA Examiners Tip

"Ensure that you can explain how physical and human features and processes can affect the amount of water flowing in rivers"

Causes of Flooding

Physical Factors

- Severe weather such as **heavy** or **continuous precipitation** (rainfall) is the most common cause of river flooding in the UK.
- Impermeable surfaces, such as **baked** or **saturated soil**, increases surface flow and the amount of water entering the river system.
- **Snow melt** in spring can lead to flooding in mountainous regions where thick layers of snow have built-up over the winter.
- In upland areas with **steep gradients** there is little time for water to infiltrate into the soil, shortening lag time.

Human Factors

- In wooded areas trees may intercept rainfall, trapping rainwater on their leaves. Additional rainwater may be absorbed by their roots and released back to the atmosphere through transpiration. When forests are cut down (**deforested**) less rainwater is intercepted and transpired so more water reaches the river and gets their quicker.
- In urban areas, the landscape is made up of mainly **impermeable** surfaces. As rainfall is unable to penetrate the surface, water flows into the drains and directly to the river. Sloping roofs also increased run-off and reduce surface storage.
- Changing farming techniques have lead to increased surface runoff. **Up-and-down ploughing** channels rainwater quickly downhill shortening lag time.
- The extensive use of fossil fuels and changing farming practices, have increased the amount of greenhouses (e.g. carbon dioxide and methane) in our atmosphere. These gases 'trap-in' the sun's heat warming our climate. **Higher global temperatures** have lead to an increase in extreme weather conditions, such as hurricanes and droughts, and increasingly unpredictable rainfall patterns.

Impermeable (Hard) Rock:

Under the soil so the rain cannot soak through

Hard Dry Soil:

When the soil is baked hard in summer the rain runs over.

Factors that increase the risk of flooding

Wet Soil:

When the soil is full of water no more rain can soak through.

Buildings:

Rain cannot soak through tarmac and pavements

Cut down trees:

Leaves slow rainfall and roots take in water.

Steep Slopes:

Rain will run down a steep slope quickly

REMEMBER:

PHYSICAL: Things created by nature

HUMAN: Things created by people

Flooding MEDC: Tewkesbury

stershire, Bedfordshire, Oxfordshire and Berkshire.
-Total cost of July floods was £6 billion.

CAUSES

What Caused the Flooding?

-The ground was already saturated
-On 21 July 83mm of rain fell in a few hours (3 times average for July).
-Heaviest rain fell on Tewkesbury and Evesham
-River Severn burst its banks.
-Much of the valley is low lying so flood waters quickly spread.
-Much development on the flood plain of the river so little infiltration could take place.
-Drains became blocked so water could not run-off.

Key Words and Terms

-rainfall
-saturated
-contaminated water
-floodplains
-burst banks
-emergency response
-relief aid
-water treatment
-bowsers
-flood defences

EFFECTS

What were the effects of the flooding?

-Over 350 000 people lost access to running water for 2 weeks.
-Water supplies were contaminated with sewage.
-Homes and hospitals also lost electricity supply.
-On the night of 21 July thousands of motorists were stranded on the M5. Rail passengers were also stranded at Gloucester station.
-3 people died. Two men died trying to pump water out of Gloucester Rugby Club.
-Thousands of people were forced to leave their homes. Belongings were lost and damaged.
-many were trapped in their homes and had to be rescued by boat or helicopter.
-Water treatment works closed.
-Increase in cost of milk, bread and meat as farmers were unable to meet demand from consumers.
-increased debate about the wisdom of building on floodplains.

RESPONSES

How did the authorities respond?

-RAF Rescue helicopters scrambled to rescue people from roof tops (emergency response).
-Fire and Rescue services rescued people and pumped water from flooded buildings.
-Flood Relief Fund set up to raise money for householders (relief aid).
-Severn Trent Water Company brought 50m litres of bottled water in. Also moved 1300 water bowsers and 100 tankers into area.
-Severn Trent donated £3.5m to communities most affected.
-The Mythe Water Treatment works was repaired restoring water to most homes by the end of July.
-Other water companies sent tankers to affected area.
-British Red Cross sent food parcels to community centres where homeless residents were sheltering.
-Governmental review into flood defences set up.
-Visits to the area by the Prime Minister and Prince Charles.

Flooding LEDC: Bangladesh

FACTFILE

Bangladesh is one of the **world's poorest and least developed** nations in the world

Population: 131,269,860 (July 2001 est..)

Main language: Bangladeshi version of Bengali: 'Bangla'

Infant mortality rate: 69.85 deaths per 1,000 live births (2001 est..)
Life Expectancy: 60.54 years

People per doctor: 12,500

Literacy: 56%

Unemployment rate: 35.2% (1996)

Percentage of population with access to safe water: 97%

PHYSICAL CAUSES OF THE FLOODING

- Most of the country consists of a huge flood plain and delta . 70% of the total area is less than 1 metre above sea level
- 10% of the land area is made up of Lakes and Rivers
- Snowmelt from the Himalayas takes place in late spring & summer
- Bangladesh experiences heavy monsoon rains, especially over the highlands
- Tropical storms bring heavy rains and coastal flooding
- The main cause was the above average & long period of heavy rain which caused all 3 rivers to have their peak flow at the same time!!!

HUMAN CAUSES OF THE FLOODING

- Deforestation in Nepal and the Himalayas increases run off and adds to deposition and flooding downstream
- Urbanisation of the flood plain has increased magnitude & frequency of floods
- the building of dams in India has increased the problem of sedimentation in Bangladesh
- Global warming is blamed for sea level rise, increased snow melt & increased rainfall in the region
- Poorly maintained embankments (levees) leak & collapse in times of high discharge

THE EFFECTS OF THE FLOODING

Over 57% of the land was destroyed by floodwater

- Over 1300 people were killed
- 7 million homes were destroyed
- 25 million people were made homeless
- There was a serious shortage of drinking water & dry food
- Diseases spread such as bronchitis and cholera/diarrhoea
- As the waters receded - it left fields of rotting crops, wrecked roads and bridges and destroyed villages
- 2 million tonnes of rice was destroyed
- 1/2 million cattle and poultry were lost

THE RESPONSES OF THE FLOODING

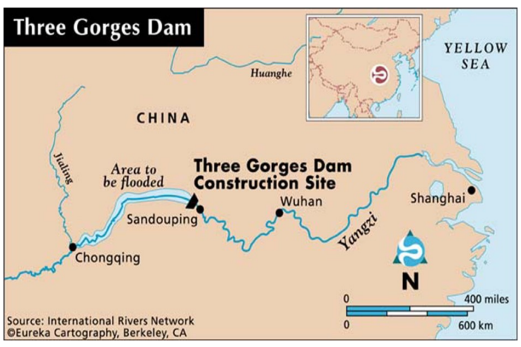
Bangladesh GNP: $380 PER PERSON

- Short term concern is always for health survival and suffering of people affected.
- A heavy reliance is placed upon emergency aid – food, drinking water medicines, plastic sheets, boats
- Assistance is provided from United Nations, governments, charities
- Problem is distribution because so much of the country is underwater.
- As flood water recedes it is easier to set up medical treatment centres, distribute water purification tablets and provide help with repairing homes and restarting economic activities

Flooding Management

Flood Protection Measure				
Type	**Hard**		**Soft**	
Strategy	**Dams**	**River Channel Modification**	**Afforestation**	**Washlands**
Benefits 	**1.** Discharge regulated – floods prevented; **2.** HEP potential; **3.** Recreation opportunities.	**1.** Straightening and deepening the channel allows a large amount of water to flow quickly through the river.	**1.** Intercepts rainfall; **2.** Holds soil in place reducing erosion; **3.** Relatively cheap; **4.** Creates habitats for wildlife; **5.** Recreation opportunities.	**1.** Allowing some parts of the river to flood naturally reduces risk in urban areas; **2.** Flooding leads to marshlands – important ecosystems.
Drawbacks 	**1.** Expensive; **2.** Sediment trapped possibly leading to problems downstream; **3.** Spoils the view **4.** Flood prevention may lead to fertility problems.	**1.** Expensive; **2.** May require regular maintenance; **3.** Destructions of habitats; **4.** Un-natural look; **5.** Moves flood risk downstream.	**1.** Floods still occur; **2.** Large areas of land needed; **3.** Forests need to be carefully managed to maximise effect.	**1.** Floods still occur; **2.** Productive farmland may be lost; **3.** Local residents may have to move.

CASESTUDY FLOODING MANAGEMENT: THREE GORGES DAM, CHINA



WHY WAS IT NEEDED? In 1988 huge floods in china caused chaos!! The floods left a clay sediment over all the fields making the soil less fertile. The cost of those floods were 500 million. The Chinese government (communist) decided to built a dam up the river Yangtze to control the floods. It is the biggest dam in the world. The dam wall is 2335 meters long and 185 meters high, the maximum water level is 150 meters high. It is also 115 meters wide on the bottom and 40 meters wide on top. It is to be finished in 2009 and the total cost of the project will add up to around 15 billion.

THE IMPACTS?

ECONOMIC: The dam is a multi-purpose project built to prevent flooding AND create HEP.

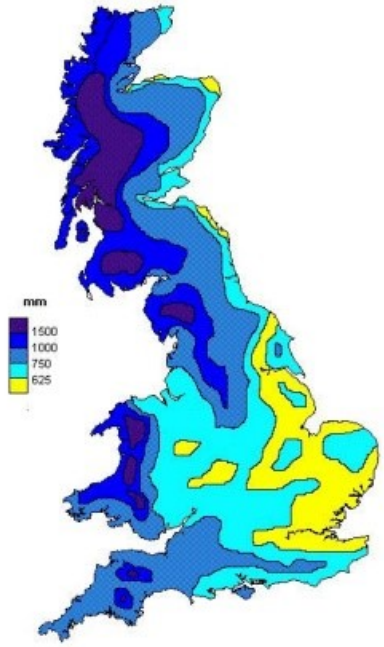
The HEP station will generate electricity equivalent to 18 nuclear power stations. 14 % of China's power.

Stopped flooding from a 1 in 10 year event to a 1 in 100 year event

ENVIRONMENTAL: 100 river dolphins left in the area as dam has destroyed habitat, 60,000 hectares of fertile farmland will be flooded

SOCIAL:828 religious cultural and archaeological sites will be flooded including important Buddhist carvings 66% of Wanxian city will be flooded. Some 900 factories and 250000 people will have to move

UK Water Management



In the UK, the supply and demand for water differs.
On average the annual rain in the UK shows that Scotland, the north of England, the west of England and Wales have the largest amount of precipitation on average each year.
On average the population density shows how many people are in each area. Scotland, Wales and the north of England have low population densities.
This means basically these areas are water surplus. This means that that on average, the high population areas have a water deficit, and the low population areas have water surplus.

The UK manages its water supply and demand problems. It does this by:

- Transferring water from areas of surplus to areas of deficit. (For example Wales transports water to Liverpool)
- Fixing leaky pipes means less water is lost by transfer.
- Build more reservoirs to store more water.
- Reduce amount of water used.
- Encouragement of water meters..

CASE STUDY WATER MANAGEMENT IN UK: LAKE VYRNWY AND DAM

LOCATION: River Vyrnwy is located in Powys, central Wales
FACTS: - a Traditional solution to unequal water supply, there is an area of water surplus (Wales) and an area of water deficit (Liverpool)
Construction of dam and pipeline began in 1881 and completed in 1888. First stone dam in the UK.

SOCIAL ISSUES: New village had to be built 3km from the original called Llanwddyn. Original Village flooded: 2 chapels, 3 inns, 10 farmhouses and 37 houses demolished

ECONOMIC ISSUES: Loss of farmland and livelihoods
ENVIRONMENTAL ISSUES: Loss of wildlife habitats

SUSTAINABLE SUPPLIES: Transfer schemes are expensive. Building dams is a hard engineering strategy. Local schemes are more sustainable.

REVISION FLASHCARDS: WATER ON THE LAND

Processes of river erosion

Hydraulic action: force of the water
Abrasion: sand, boulders erode channel
Attrition: load breaking up smaller pieces
Solution: some rocks dissolve in river water

Processes of transportation

Traction: boulders roll along river bed
Saltation: small pebbles bounced along
Suspension: sand / silt carried in flow
Solution: dissolved minerals carried away

Valley long and cross profiles

Upper course **long profile**: irregular, steep
Lower course: lower, smoother, less steep
Upper course **cross profile**: steep V shape
Lower course: gentle V shape, flat

Landforms of river erosion

Mainly found in upper course
Waterfalls, gorges, interlocking spurs
Formed by **vertical erosion**
River cutting down towards sea level

Formation of waterfall and gorge

Alternate outcrops of hard and soft rocks
Hard is eroded slowly, soft is eroded fast
Soft rocks undercut by water splashback
Waterfall retreats upstream, leaving a gorge

Landforms of river deposition

Mainly found in lower course
Levées, flood plains, deltas
River carries a large load of sediment
Deposited where water flow slowed down

Formation of meander and ox-bow lake

Outside bend: strong flow, erosion, cliff
Inside bend: weak flow, slip-off slope
Meander size increased by **lateral erosion**
Narrow meander neck broken in a flood

River discharge

Volume of water flowing in a river
Factors: the weather, rock type, relief
High discharge after heavy, prolonged rain
Particularly impervious rock, steep slopes

Causes of flooding

Physical: factors favouring high discharge
Wet weather before; ground is saturated
Snow melts, cool weather, little evaporation
Human: deforestation, building construction

Hard engineering strategies

Structures built to prevent flooding
Dams and reservoirs
Concrete / stone channel sides
Raising the height of river banks

Soft engineering strategies

Measures to reduce the scale of flooding
Plant trees on steep valley sides
Zoning: stop more building on flood plains
Issue flood alerts; prepare e.g. sandbags

Water supply in the UK

Water surplus: north and west of UK
High precipitation, lower population density
Water deficit: south and east England
Lowest precipitation, highest population

Restless Earth Exam Questions

TRY some of these exam questions on lined paper or in your exercise books. Bring them to revision sessions and lessons if you would like them to be marked by your class teacher!

1. Using examples, describe some of the hazards of living on a destructive plate margin (4) Foundation
2. Using an example, outline the impact of a major earthquake on people and property in the developing world (9) Higher
3. Describe 2 ways in which buildings in developing countries can be made more resistant to earthquakes (2)
4. Explain how preparation and prediction could reduce tectonic hazards (volcanoes and earthquakes) (4)
5. Explain why some areas are more vulnerable than others (4)
6. Explain the role magma plays in shaping shield volcanoes (2)
7. How do tectonic plates move? (2)
8. Outline the responses made by a country to reduce the risk of future earthquakes. (9 marks HIGHER/6 mark FOUNDATION)
9. Using a diagram describe how volcanoes are formed along destructive plate margins (4 marks)
10. Using an example, Describe the potential impacts of a supervolcanic eruption (6 marks)
11. Using a case study outline the impacts of a tsunami on a land and its community (6 marks FOUNDATION/9marks HIGHER)

Water on the Land Exam Questions

TRY some of these exam questions on lined paper or in your exercise books. Bring them to revision sessions and lessons if you would like them to be marked by your class teacher!

1. What is the difference between the long profile and the cross profile of a river? (2 Marks)
2. Explain why the upper course of a river valley has a different cross profile from the lower course. (4 Marks)
3. Name and describe two other processes by which material is transported in Rivers. (4 Marks)
4. Deposition occurs when rivers slow down. Why do Rivers Slow down? (4 Marks)
5. Using a Diagram Explain the formation of a River cliff. (3 Marks)
6. Using a Diagram Explain the formation of an ox-bow lake. (6 Marks)
7. Describe, using a diagram the formation of Waterfalls. (6 Marks)
8. What is a flood plain? (1 Mark)
9. What are levees? and explain how they are formed (3 Marks)
10. Explain what the following terms mean:
    i) Peak discharge ii) Lag time (2 Marks)
11. Describe and compare the primary and secondary effects of flooding in an MEDC and in an LEDC. (6 Marks)
12. What is meant by hard and soft engineering strategies? (2 Marks)
13. Give two ways in which the supply of water in the UK can be managed. (2 Marks)
14. Describe the economic, social and environmental impact of a studied Reservoir (8 Marks)