Topic 4A: River Processes and Pressures

Three types of weathering

Mechanical weathering— freeze-thaw is most common in colder climates. When the water freezes in joints and faults it expands and causes the faults and joints to widen and eventually break away.
Chemical weathering—this happens when the rocks mineral composition is changed. Granite contains feldspar which turns to clay when it reacts with water making it easier to erode. Limestone is dissolved by carbonation as it is alkali and water is acidic.
Biological weathering—Caused by plants and animals, this helps speed up erosion. Trees roots can cause cracks and faults to be created and bird poo (guano) can dissolve minerals in rocks.

Three types of mass movement

Mass movement—the downhill movement of material under the influence of gravity. There are different types that depend on the material involved, how saturated the material is and the nature of movement. E.g.
Sliding/ creeping - loosened rocks and soil suddenly tumble down the slope.
Slumping—happens when rock is saturated with water and slides down a curved slip plain.

Erosion:

Hydraulic action—the force of the wa
on the bed/banks of the river.
Abrasion—the rivers bedload scrapes
the banks and bed of the river.
Attrition—rocks and pebbles collide.
Solution—chemical action by water,
dissolves minerals in rocks.

Factors affecting river processes—

Erosion rate—this is greater where the discharge is higher and energy is higher. The wetter the weather the more erosion takes place.
Transportation—Greater where water energy is greater which is when it is wetter.
Weathering—Greater in colder weather.
Amount of discharge—affected by climate, the wetter the weather/season the higher the river discharge.

Transportation:

Traction– large boulders are rolled along the river l
Saltation—smaller stones are bounced along the ri
bed.
Suspension—sand and small particles are carried a
in the flow.
Solution—some minerals are dissolved in water.
Deposition -When the river loses energy it may dro
some of its load. This is called deposition

Exam questions:

1. Describe one change in gradient and one change in discharge along the course of a named UK river (3)
2. Describe one type of river erosion (2)
3. Describe one method of river transportation (2)
4. Explain how geology influences river landforms and sediment load (4)
5. Describe two slope processes that influence river landscapes (3)

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Upper course features

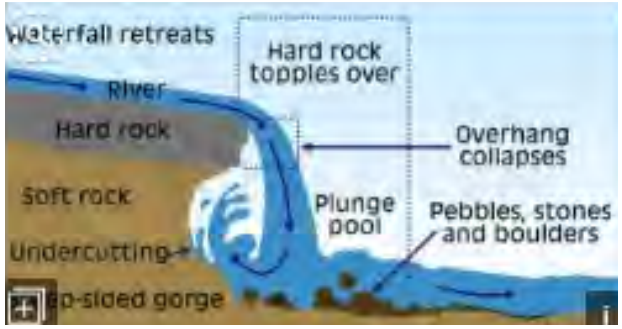
Waterfalls—

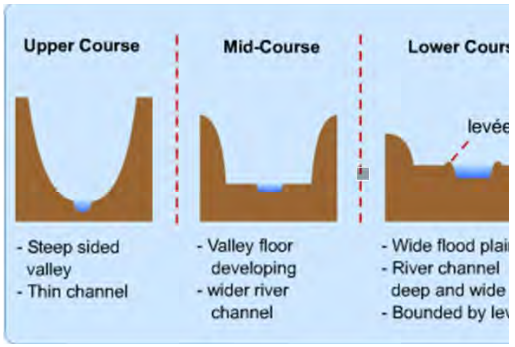
A band of more resistant rock lies over less resistant rocks. Less resistant rock erodes quicker leaving a step– the waterfall. More resistant rock is undercut, forming an overhang. The overhang can no longer be supported, blocks of rock fall down. Powerful fall of water erodes a plunge pool using fallen rocks. The waterfall retreats upstream leaving a steep sided gorge.

Interlocking spurs—

Vertical erosion is more dominant in the upper course leaving a steep sided valley. The river has limited energy and flows side to side, around ridges called spurs. The spurs become interlocking.

Characteristic	Upper course	Middle course	Lower course
Gradient	Steep	Less steep	Shallow gradient
Discharge	Small	Large	Very large
Depth	Shallow	Deep	Deep
Channel	Narrow, steep sides	Flat, steep sides	Flat floor, gently sliding slopes
Velocity	Quite fast	Fast	Very fast
Valley shape	Steep sides	Flat, steep sides	Flat, gently sloping sides
Features	Waterfalls, interlocking spurs	Meanders, floodplain	Meanders, ox-bow lakes levees





Middle course features

Meanders—

these are bends in the river's course. Lateral is more dominant. The velocity of the river is higher along the outside bend; therefore, erosion is dominant. Or the inside bend the velocity is lower and therefore deposition occurs.

Ox-bow lakes–

When the neck of a meander is eroded through, the river takes a straight course and deposition occurs blocking the bend. Thus forming an ox-bow lake.

Lower course features

Levees—

As the river floods over its banks, the water slows down. The water can't carry the biggest and heaviest silt particles and they are dropped straight away on the bank forming floodplains. Increased deposition on the river bed when the river is low gradually raises the river bed upwards. After many floods, the deposits on the bank build up forming, levees.

Deltas-

The speed of a river decreases as it approaches the sea and it deposits most of the material it has been carrying. Over time sediment builds up to create an almost flat area of new land, which is the delta.

Exam questions:

1. What two types of erosion are usually dominant in the formation of a waterfall plunge pool? (2)
2. Briefly describe how interlocking spurs form (2)
3. Explain how erosion and deposition form floodplains (4)
4. Briefly describe the main process affecting the lower course of a river (4)
5. Explain how levees are formed (3)

Physical factors affecting hydrographs:

Geology– more resistant rock absorbs less water and therefore encourages runoff.

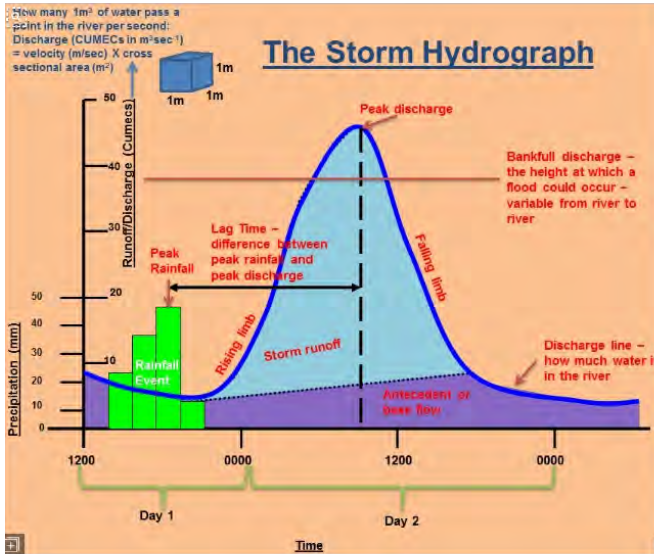
Soil type—more impermeable soils absorb less water and encourage runoff.

Vegetation– Plants encourage interception and this creates less runoff.

Slope– steeper slopes cause faster surface runoff.

Drainage basin shape– a wide basin with lots of tributaries close together encourages a steeper rising limb and short lag time.

Antecedent rainfall– when the ground is already saturated with water any extra water will create runoff.



Storm hydrographs and flooding:

Storm hydrographs are a way to show flooding on a graph.

- Lag time—the difference between peak rainfall and peak discharge.
- Bar graph—this shows rainfall in mm
- Line graph—shows discharge in cumecs.
- Rising limb
- Falling limb

Human factors-

Urbanisation– Cities growing and creating impermeable surfaces.

Deforestation– Less vegetation leads to less interception and more runoff.

Land-use change– fields that used to drain water and store water become impermeable and therefore runoff occurs.

Building on floodplains—Humans building on areas susceptible to flooding.

Types of river management

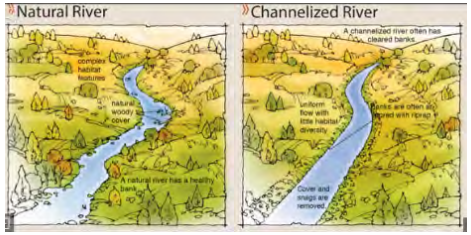
- Flood walls– require minimal maintenance, block the view of the river.
- Dams and reservoirs– scientists can regulate and control the water flow, expensive.
- Flood barriers—can be moved to where they are needed and are quickly erected, they don't provide protection for very long.
- Soft engineering methods– Use natural materials that work with the environment.
- River restoration– reduces flooding downstream, people living nearby may not want to change the landscape
- Washlands– Restricts economic development, allows the area to develop.
- Floodplain retention– provides somewhere for the floodwater to go, restricts economic development, attractive and provides space for leisure and recreation.
- Plant trees (afforestation)- increased infiltration, not suitable for all locations.

Increasing the flood risk-

Climate change-increased frequency and intensity of storms, increased dry periods making the soils impermeable and increasing cold periods, which increases surface runoff.
Increased population – more people living by flood plains
Increased urbanisation – more construction of impermeable surfaces which increase surface run-off

Impacts of flooding-

Damage to homes, damage to agriculture, death and injury, disruption and damage to transport routes, damage to communication, damage to freshwater and electricity supplies, damage to wildlife, pollution and stress.



Afforestation	Trees are planted near to the river. This means greater interception of rainwater and lower rive discharge. This is a relatively low cost option, which enhances the environmental quality of th drainage basin.
Managed flooding (also called ecological flooding)	The river is allowed to flood naturally in places prevent flooding in other areas - for example, settlements.
Planning	Local authorities and the national government introduce policies to control urban developmen close to or on the floodplain. This reduces the chance of flooding and the risk of damage to property. There can be resistance to development restrictions in areas where there is a shortage housing. Enforcing planning regulations and controls may be harder in LEDCs.

Dam construction	Dams are often built along the course of a river in order to control the amount of discharge. Water is held back by the dam and released in a controlled way. This controls flooding. Water is usually stored in a reservoir behind the dam. This water can then be used to generate hydroelectric power or for recreation purposes. Building a dam can be very expensive. Sediment is often trapped behind the wall of the dam, leading to erosion further downstream. Settlements and agricultural land may be lost when the river valley is flooded to form a reservoir.
River engineering	The river channel may be widened or deepened allowing it to carry more water. A river channel may be straightened so that water can travel faster along the course. The channel course of the river can also be altered, diverting floodwaters away from settlements. Altering the river channel may lead to a greater risk of flooding downstream, as the water is carried there faster.

Exam questions-

1. Explain how human activities can alter a storm hydrograph (4)
2. Explain how two physical factors affect storm hydrographs (4)
3. Explain how human and physical processes are causing river flooding on a named river (4)
4. Identify two threats of flooding to people (2)
5. Explain how land-use change can increase the risk of flooding (4)
6. Explain one cost and one benefit of a soft engineering approach to managing rive flooding (4)
7. Explain one cost and one benefit of a hard engineering approach to managing river flooding (4)