

O Level Elect Geog

Chap 6: Rivers

River System

- River source may be a lake or melting snow on top of a mountain.
 - The volume of water increases down its course because tributaries (streams) join the main river as it flows downhill.

	Upper course	Middle course	Lower course
River channel	Narrow and shallow	Wider	Widest
Gradient	Steep	Less steep	Gentle
Volume of water	Low	Higher	Highest

- A drainage basin is the land area drained by the main river and its tributaries. A watershed is a boundary which separates one drainage basin from the next.

Energy of a River

- The energy of a river is determined by the speed and volume of the river. It changes along its course because the river's speed and volume change as it flows through the 3 courses.

Factors affecting the speed of a river

a) Gradient of channel

If the gradient of the channel is steep, the river's speed will be high (due to gravity).

b) Roughness of channel

A river's channel may contain obstacles such as rocks, underwater vegetation or an uneven sea bed. Friction between the water and the channel will reduce the speed of the river. Hence, a river with a smoother channel (i.e. fewer obstacles) will flow faster.

c) Wetted perimeter

When the wetted perimeter (length and breadth of the channel in contact with the river's water) is large, more friction is generated between the water and the channel, causing the river to flow slower. This causes the river to flow slower.

Factors affecting the volume of water in a river

a) Size of drainage basin

For large drainage basins, there is more surface area for rain to fall on. The rain flows over the land as surface runoff or seeps into the ground before reaching the river. Bigger drainage basins "collect" more rainwater, leading to higher volume of water.

b) Presence of vegetation

When vegetation is sparse, rainwater interception will be low. This leads to low water infiltration and high surface runoff which flows into the river, hence volume of water in river is high.

c) Permeability of rocks

An area with less permeable rocks decreases infiltration and increases surface runoff, hence volume of water in river is high.

d) Climate

In areas with distinct wet and dry seasons, the amount of water in the channel fluctuates according to the amount of rainfall received during each season. For places with high rainfall, the river's volume of water will be high.

3) River Processes

- The energy of a river determines the processes that occur as the river moves along its course. When the river has high energy, it is able to erode and transport materials until it loses its energy and deposits them on the river bed.

Erosion

- Erosion is the process of wearing away land surface by water and other agents
- Types of erosion: vertical erosion and lateral erosion
- The energy of fast-moving water in a river causes erosion to occur

Processes involved in erosion (that occur simultaneously):

Erosion process	Erosive agent	Impact
Hydraulic action	Fast-flowing water	The force of fast-moving water is strong enough to loosen the rocks and materials along the river bed and banks. They are eventually dislodged and carried down the river.
Corrasion	Rock fragments	Occurs when rock fragments are dragged along the river bed or against the river banks. This grinding action causes the widening and deepening of the river channel.
Attrition	Rock fragments	Previously eroded materials carried by the river collide against each other and are worn down into smaller pieces.
Solution	Carbonic acid in water	As rain falls to Earth's surface, it reacts with carbon dioxide present in the atmosphere forming carbonic acid. As this rainwater falls into rivers, the weak acid dissolves minerals present in rocks and is carried away in solution. E.g. river flows over limestone forming calcium bicarbonate through carbonation.

Transportation

Transportation process	Type of load	
Traction	Pebbles	Larger sized materials roll or slide along river bed
Saltation	Coarse sand particles	Smaller materials transported in bouncing motions (lifted up and dropped onto river bed repeatedly)
Suspension	Clay and sand	Finer particles held in suspension in the water (e.g. murky river)
Solution	Dissolved materials	Dissolved materials (e.g. calcium carbonate from rocks dissolved in river water) carried by running water downstream

Deposition

- Occurs when a river does not have enough energy to erode or transport material and deposits the load it is carrying.
- Usually occurs when speed of river is reduced.

E.g. during a period of low rainfall, the volume of water drops causing the speed of the river to also drop, leading to deposition.

- Larger particles such as rocks are deposited first, followed by sand and clay.

4) Landforms Formed by River Processes

a) Waterfalls

- Sudden, steep, vertical flows of fast-flowing water falling from great heights. Usually found in the upper course of a river where gradient is steep.
- Formation through unequal resistance of rocks:
 - A river flows across rocks of different resistance.
 - The river erodes the less resistance rock more rapidly, causing a change in the gradient of the river course.
 - Over time, the river plunges from a great height to hit the river bed below with great force (waterfall formed). Repeated pounding of the river bed may leave a depression at the waterfall's base, and is deepened as rocks swirl around, forming a plunge pool.
 - E.g. Niagara Falls, which stretches across two countries
- Formation through faulting

b) Gorges

- Deep, narrow and steep-sided valley. Usually found in upper course of a river.
- When a river flows over an area of very resistant rocks by its sides, it erodes its channel vertically faster than the sides of the valley can be worn away.
- Overtime, as vertical erosion continues, a gorge is formed.

c) Valleys

- A low area between hills or mountains.
- Upper course: due to steep gradient of land, the river has sufficient energy to erode the rocks in its path and cut deep into the channel, causing vertical erosion. V-shaped, narrow and steep-sided valleys are formed.
- Middle course: gradient of land is not as steep; river flows with less energy and cuts less deeply into its channel. Lateral erosion occurs more than vertical erosion. Sides of valley are wider than in upper course.
- Lower course: gradient of land is gentle, lateral erosion rather than vertical erosion occurs. Broad flat-floored valleys are formed.

d) Floodplains and levees

- When there is heavy rain, a river may overflow its banks, causing the land on either side of the river to be flooded. When the water recedes, the river deposits the material it is carrying on the land, leaving behind alluvium on the river banks and river beds.
- The coarse sediments are deposited closer to the river's edge because they weigh more, while the fine particles are deposited further away from the river.
- As alluvium builds up on both sides of the river with more flooding, wide flat plains called floodplains are formed on either side of the river. The heavier and coarser materials nearer to the river form raised banks called levees. These features are found at the lower course of a river.
- E.g. Indus Floodplains in South Asian continent

e) Meanders*

f) Oxbow lakes*

g) Deltas and distributaries