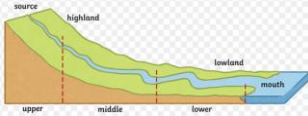
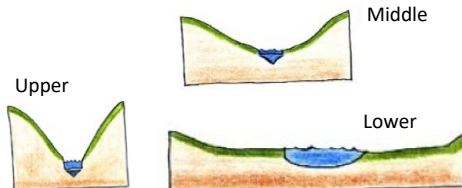
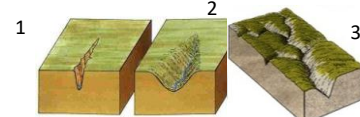
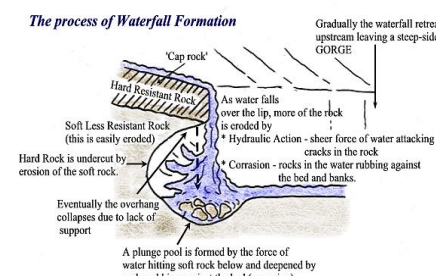
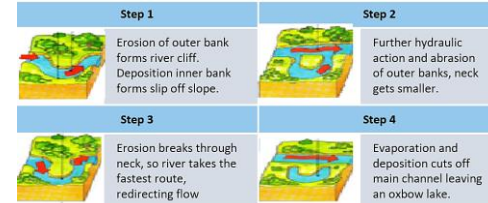
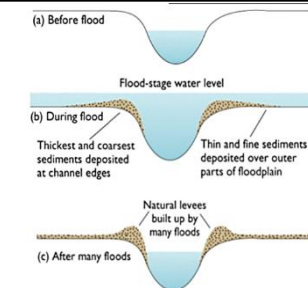


A. The shape of river valleys changes as rivers flow downstream: The long profile and changing cross profile of a river and its valley		
1	Long profile	Shows the height and gradient of a river from its source to mouth. Often depicted as a diagram:  Useful to illustrate the upper, middle and lower course of the river.
2	Upper course	The upper section of a river and its valley. Includes the source. Usually located on high land where rainfall is plentiful. Dominant process is erosion as the river tries to 'cut down' to sea level (also known as base level). Most erosional landforms are found here, such as waterfalls and V shaped valleys. Has a steep gradient and a narrow valley.
3	Middle course	The middle section of the river and its valley. Found on lower land. Processes of both erosion <u>and</u> deposition are active here. Landforms such as meanders and ox-bow lakes are commonly found. Here the river channel and valley are wider and the gradient is more moderate.
4	Lower course	The final stage in the long profile. Located towards the mouth of the river on low-lying, flat land. Deposition is the dominant process creating landforms such as levees, floodplains and estuaries. As the river reaches its end the gradient becomes gentle and the river and its valley much wider.
5	Cross profile	Shows the shape of the river channel and/or valley from one side (bank) to the other. This changes drastically with distance downstream. Again, often shown as a diagram: 
6	Fluvial processes	Processes of erosion, transportation and deposition that occur within a river system. They shape the river and its valley.

A. The shape of river valleys changes as rivers flow downstream: Fluvial Processes		
1	Erosion	<p>Hydraulic Action: This is the force of the water in the channel hitting against the bed and banks, gradually wears them away – particularly occurs at high-velocity flows.</p> <p>Abrasion: This is the scraping away of the river bed and banks by stones picked up and carried in the rivers flow. Like a sandpaper effect.</p> <p>Attrition: Rocks bang against each other, gradually breaking down (rocks become smaller, smoother and less angular as attrition occurs)</p> <p>Solution: The dissolving of minerals in the rocks of the bed and banks which are carried away in solution in the water. Rocks such as limestone are easily dissolved.</p> <p>Vertical erosion: Occurs mostly in the upper course where the river is cutting down to base/sea level. Deepens the river valley and creates a 'V' shape.</p> <p>Lateral erosion: Occurs mainly in the middle and lower course. Here the river cuts sideways widening the channel and the valley.</p>
2	Transportation	<p>Traction: Large particles rolled along the river bed by the force of the water.</p> <p>Saltation: A bouncing or hopping motion by pebbles too heavy to be suspended.</p> <p>Suspension: Particles suspended within the water.</p> <p>Solution: Chemicals dissolved in the water.</p>
3	Deposition	Involves the dropping of sediment that has been transported by the river. River sediment is deposited in low flow conditions when the river loses energy and the velocity is so slow that the river can no longer carry the sediment load. Usually happens on the inside bend of a meander, at the estuary and mouth where tidal influences slow the river flow or anywhere along the river's course at times of low discharge.

B. Distinctive fluvial landforms result from different physical processes		
1	Characteristics and formation of landforms resulting from erosion.	<p>Interlocking spurs, waterfalls and gorges</p>  <ol style="list-style-type: none"> The river uses its load to cut into the bedrock (vertical erosion). Material loosened by weathering is washed into the river increasing its erosive power. The river takes a winding path due to projections of hard rock. These form interlocking spurs; the river's forced to wind round them <p>The process of Waterfall Formation</p>  <p>Gradually the waterfall retreats upstream leaving a steep-sided GORGE</p> <p>As water falls over the lip, more of the rock is eroded by Hydraulic Action - shear force of water attacking cracks in the rock</p> <p>Corrosion - rocks in the water rubbing against the bed and banks.</p> <p>Eventually the overhang collapses due to lack of support</p> <p>A plunge pool is formed by the force of water hitting soft rock below and deepened by rocks rubbing against the bed (corrosion)</p>
2	Characteristics and formation of landforms resulting from erosion and deposition.	<p>Meanders and ox-bow lakes</p>  <ol style="list-style-type: none"> Erosion of outer bank forms river cliff. Deposition inner bank forms slip off slope. Further hydraulic action and abrasion of outer banks, neck gets smaller. Erosion breaks through neck, so river takes the fastest route, redirecting flow Evaporation and deposition cuts off main channel leaving an ox-bow lake.
3	Characteristics and formation of landforms resulting from deposition.	<p>Levees, flood plains and estuaries.</p>  <ol style="list-style-type: none"> Before flood During flood: Thickest and coarsest sediments deposited at channel edges; Thin and fine sediments deposited over outer parts of floodplain After many floods: Natural levees built up by many floods

B. B. Distinctive fluvial landforms result from different physical processes: Example: River Tees	
1	<p>An example of a river valley in the UK to identify its major landforms or erosion and deposition.</p>
2	<p>Location and Background</p> <p>Located in the North of England and flows 137km from the Pennines to the North Sea (Tees estuary) at Red Car.</p>
2	<p>Upper course</p> <p>The source is located at Tees Head, close to Cross Fell-altitude 893m ASL. Features include V-shaped valley, interlocking spurs, rapids and waterfalls. Highforce Waterfall-located close to Forest-in-Teesdale-drops 22m and consists of harder Whinstone cap rock with underlying softer limestone. An impressive 700m gorge has formed in front of the falls.</p>
3	<p>Middle course</p> <p>Here the gradient becomes more moderate and the valley widens. Features include meanders and ox-bow lakes created by lateral erosion and deposition. The meander near Yarm encloses the town.</p>
4	<p>Lower course</p> <p>Greater deposition creates features such as floodplains & levees near Darlington. Mudflats form due to deposition at the river's estuary. Some areas of the estuary are designated SSSI's but there is also plenty of industry at the mouth of the river.</p>

C. Different management strategies can be used to protect river landscapes from the effects of flooding.	
1	<p>How physical and human factors affect the flood risk: Precipitation, geology, relief and land use</p> <p>Physical: Prolong & heavy rainfall Long periods of rain causes soil to become saturated leading to runoff and increased flood risk.</p> <p>Physical: Geology Impermeable rocks cause surface runoff to increase river discharge. Permeable rocks allow water to pass through them and porous rocks absorb/hold water so reduce river discharge.</p> <p>Physical: Relief Steep-sided valleys channel water to flow quickly into rivers thus increasing discharge and flood risk.</p> <p>Human: Land Use Tarmac and concrete are impermeable. This prevents infiltration & causes surface runoff. Deforestation reduces interception and increases soil erosion. This causes surface runoff and increases flood risk.</p>
2	<p>The use of Hydrographs to show the relationship between precipitation and discharge</p> <p>▲ Figure 11.42 A typical flashy response hydrograph</p>

C. Different management strategies can be used to protect river landscapes from the effects of flooding.	
1	<p>The costs and benefits of the following management strategies: Soft Engineering</p> <p>Floodplain zoning-restrict land use to certain locations. Place low risk uses such as sports fields in high risk areas. River restoration – return river to original course e.g. River Quaggy. Work to understand natural processes. Flood warnings and preparation-Environment Agency warns those in high risk areas which allows people/councils etc. to prepare for flood events. Planting trees-Tree planting within the catchment increases interception and absorption of water by trees. This reduces the speed/amount of runoff.</p>
2	<p>The costs and benefits of the following management strategies: Hard Engineering</p> <p>Dams and reservoirs – regulate river flow and allow water to be held back during times of high flow. Straightening Channel – increases velocity to remove flood water; can create flooding issues downstream. Embankments (Artificial Levees) – heightens river banks so flood water is contained. Flood relief channel – man made channel to by-pass an urban area e.g. Jubilee River.</p>
C. Different management strategies can be used to protect river landscapes from the effects of flooding.	
1	<p>An example of a flood management scheme in the UK to show: Why the scheme was required.</p> <p>The Jubilee River is a relief channel for the River Thames in south-east England. The area is part of the Thames flood plain and prone to flooding. It contains the royal settlement of Windsor, as well as Eton, home of a prestigious public school. Given the high-value property in this area, the EA decided to increase the level of flood protection.</p>
2	<p>Management Strategy - 2002</p> <p>Funded by the Environment Agency (cost £10 million.) It is the UK's largest artificial channel (12km long and 50 m wide). The channel was designed to look like a natural river, so it has meanders and shallow reed beds and a nature reserve with bird hides has been created in the area. It has five weirs (large dams) along its course. The Jubilee River effectively diverts water from the River Thames and prevents the Thames from overflowing its banks.</p>
3	<p>Social, Economic and Environmental Issues</p> <p>Social -Is it ethical to protect some properties at the expense of others? Economic – cost £10 million, continual repair costs. Homes and businesses flooded downstream. Environmental – Flooding downstream. Natural ecosystems disrupted. Algae collecting behind the weirs. Concrete weirs are unattractive.</p>

<p>1) Abrasion Rocks carried along by the river wear down the river bed and banks.</p>
<p>2) Attrition Rocks being carried by the river smash together and break into smaller, smoother and rounder particles.</p>
<p>3) Cross profile The side to side cross-section of a river channel and/or valley. .</p>
<p>4) Dam and reservoir A barrier (made on earth, concrete or stone) built across a valley to interrupt river flow and create a man-made lake (reservoir) which stores water and controls the discharge of the river.</p>
<p>5) Discharge The quantity of water that passes a given point on a stream or river-bank within a given period of time. .</p>
<p>6) Embankments Raised banks constructed along the river; they effectively make the river deeper so it can hold more water. They are expensive and do not look natural but they do protect the land around them. .</p>
<p>7) Estuary The tidal mouth of a river where it meets the sea; wide banks of deposited mud are exposed at low tide.</p>
<p>8) Flood Occurs when river discharge exceeds river channel capacity and water spills out of the channel onto the floodplain and other areas.</p>

<p>9) Flood plain The relatively flat area forming the valley floor on either side of a river channel, which is sometimes flooded.</p>
<p>10) Flood plain zoning This attempts to organise the flood defences in such a way that land that is near the river and often floods is not built on. This could be used for pastoral farming, playing fields etc. The areas that rarely get flooded would therefore be used for houses, transport and industry .</p>
<p>11) Flood relief channels Building new artificial channels which are used when a river is close to maximum discharge. They take the pressure off the main channels when floods are likely, therefore reducing flood risk.</p>
<p>12) Flood risk The predicted frequency of floods in an area.</p>
<p>13) Flood warning Providing reliable advance information about possible flooding. Flood warning systems give people time to remove possessions and evacuate areas.</p>
<p>14) Fluvial processes Processes relating to erosion, transport and deposition by a river.</p>
<p>15) Gorge A narrow, steep sided valley, often formed as a waterfall retreats upstream.</p>
<p>16) Hard engineering Involves the building of entirely artificial structures using various materials such as rock, concrete and steel to reduce, disrupt or stop the impact of river processes.</p>

<p>17) Hydraulic action The force of the river against the banks can cause air to be trapped in cracks and crevices. The pressure weakens the banks and gradually wears it away. .</p>
<p>18) Hydrograph A graph which shows the discharge of a river, related to rainfall, over a period of time.</p>
<p>19) Interlocking spurs A series of ridges projecting out on alternate sides of a valley and around which a river winds its course.</p>
<p>20) Landscape An extensive area of land regarded as being visually and physically distinct.</p>
<p>21) Lateral erosion Sideways erosion by a river on the outside of a meander channel. It eventually leads to the widening of the valley and contributes to the formation of the flood plain.</p>
<p>22) Levees Embankment of sediment along the bank of a river. It may be formed naturally by regular flooding or be built up by people to protect the area against flooding.</p>
<p>23) Long profile The gradient of a river, from its source to its mouth.</p>
<p>24) Meander A pronounced bend in a river</p>
<p>25) Ox-bow lake An arc-shaped lake which has been cut off from a meandering river.</p>
<p>26) Precipitation Moisture falling from the atmosphere - as rain, hail, sleet or snow.</p>

<p>25) Ox-bow lake An arc-shaped lake which has been cut off from a meandering river.</p>
<p>26) Precipitation Moisture falling from the atmosphere - as rain, hail, sleet or snow.</p>
<p>27) Saltation Particles bouncing down the river bed.</p>
<p>28) Soft engineering Involves the use of the natural environment surrounding a river, using schemes that work with the river's natural processes. Soft engineering is usually much cheaper and offers a more sustainable option as it does not interfere directly with the river's flow.</p>
<p>29) Solution Soluble particles are dissolved into the river.</p>
<p>30) (Channel) straightening Removing meanders from a river to make the river straighter. Straightening the river (also called channelising) allows it to carry more water quickly downstream, so it doesn't build up and is less likely to flood</p>
<p>31) Suspension Fine solid material held in the water while the water is moving</p>
<p>32) Traction The rolling of boulders and pebbles along the river bed.</p>
<p>33) Vertical erosion Downward erosion of a river bed.</p>
<p>34) Waterfall Sudden descent of a river or stream over a vertical or very steep slope in its bed. It often forms where the river meets a band of softer rock after flowing over an area of more resistant material.</p>