Paper 1: Physical Landscapes of the UK – Coasts

Relief of the UK	
Relief of the UK can be divided into uplands and lowlands. Each have their own characteristics.	
COASTS/ RIVER PROCESSES	
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.
Hydraulic Action	Water enters cracks in the cliff, air compresses, causing the crack to expand.
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.
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.	
1	Rain saturates the permeable rock above the impermeable rock making it heavy.
2	Waves or a river will erode the base of the slope making it unstable.
3	Eventually the weight of the permeable rock above the impermeable rock weakens and collapses.
4	The debris at the base of the cliff is then removed and transported by waves or river.
Types of Weathering	
Weathering is the breakdown of rocks where they are.	
Carbonation	Breakdown of rock by changing its chemical composition.
Mechanical	Breakdown of rock without changing its chemical composition.
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.	
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.	

Coast overview

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.

Size of waves depends on:

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

Types of Waves

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

Formation of Bays and Headlands (erosion)

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.

Formation of Coastal Stack (e.g Old Harry Rocks in Dorset) (Erosion)

1. Hydraulic action widens cracks in the cliff face over time.
2. Abrasion forms a wave cut notch between HT and LT.
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.

Further weathering and erosion eaves a stump.

Formation of Coastal Spits – Deposition (e.g 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.

Coastal Defences

Hard Engineering Defences		
Groynes	Wood barriers prevent longshore drift, so the beach can build up.	Pros: Beach still accessible. Cons: 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.	Pros: Long life span Protects from flooding Cons: Curved shape encourages erosion of beach deposits.
Gabions or Rip Rap	Cages of rocks/boulders absorb the waves energy, protecting the cliff behind.	Pros: Cheap Local material can be used to look less strange. Cons: Will need replacing.
Soft Engineering Defences		
Beach Nourishment	Beaches built up with sand, so waves have to travel further before eroding cliffs.	Pros: Cheap Beach for tourists. Cons: Storms = need replacing. Offshore dredging damages seabed.
Managed Retreat	Low value areas of the coast are left to flood & erode.	Pros: Reduce flood risk Creates wildlife habitats. Cons: Compensation for land.

Mappleton - Coastal Flood Defences case study

Location: Mappleton is on the Holderness Coast, East Yorkshire. The village of around 50 properties has been eroding at of 2m /year, resulting in the access road, the B1242 being only 50m from cliff edge at its closest point.

Geology of Mappleton: It lies upon soft boulder clay that erodes quickly. This material was deposited by glaciers during the last ice age 18,000 years ago.

Why defend Mappleton? The village contains around 50 properties and is home to 342 people.

What was the coastal management strategy at Mappleton?

- In 1991 almost £2 million was spent on two rock groynes and a rock revetment to protect Mappleton and the B1242 coastal road. In addition, blocks of granite were imported from Norway for the sea defences.
- The rock groynes trap beach material that would be transported away by longshore drift.
- Rock armour is at the base of the cliffs between the groynes reducing impact of hydraulic action
- The cliffs have been reprofiled, forming gentle slopes which have been stabilised with vegetation.

Positive Impacts

- The beach that has built up between the groynes further halts erosion of the cliffs
- The B1242 has been protected along with 50 properties and businesses in Mappleton.
- Local businesses have benefited from the construction of a car park and toilet facilities through the increased number of tourists, attracted by the wide, sandy beach.

Negative Impacts

- The erosion rate has increased significantly further south as the material is now trapped within the groynes. Therefore there is no beach to protect the cliffs further south eg. Cowden where the sea attacks the base of the cliffs increasing erosion and mass movement through slumping.
- There is conflict between the local authority who installed the defences and landowners at Cowden. Sue Earle, the owner of Grange Farm, has seen rates of erosion rise from 1m to 3 m per year since the defences were installed, leading to the loss of the farm and her home. She received little compensation for this