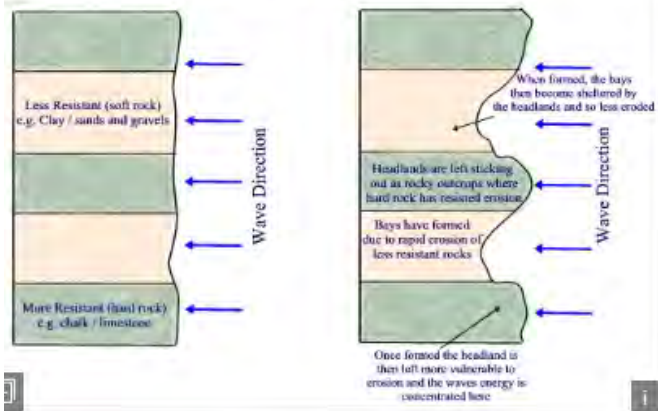
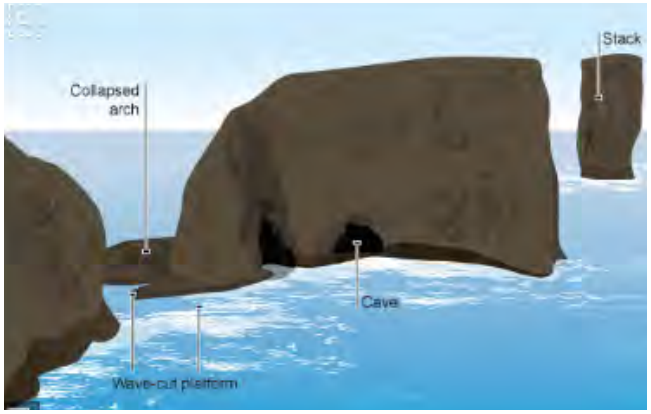
Topic 4A: Coastal Change and Conflict

Headlands and bays: Bays form due to rapid erosion of soft rock. Once formed bays are sheltered by headlands. Headlands are left sticking out where the hard rock has resisted erosion. Once formed however the headlands are more vulnerable to erosion. These are generally found along discordant coastlines.



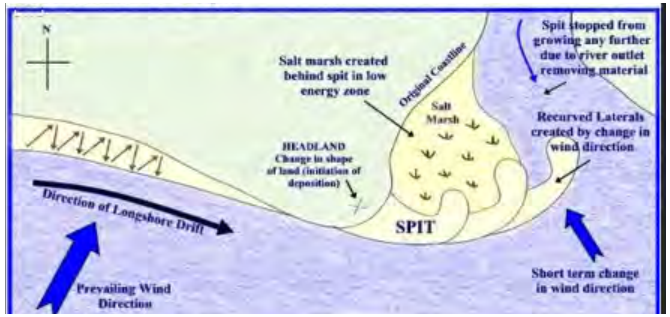
Erosional landform:

Caves, arches, stacks and stumps: A cave is formed when a joint/fault in a rock is eroded and deepens. This can then develop into an arch when two caves form back to back from either side of a headland and meet in the middle. When an arch collapses, it creates a stack. When a stack collapses it creates a stump.



Depositional landforms:

Beaches—can be straight or curved. Curved beaches are formed by waves refracting or bending as they enter a bay. They can be sandy or pebbly (shingle). Shingle beaches are found where cliffs are being eroded. Ridges in a beach parallel to the sea are called berms and the one highest up the beach shows where the highest tide reaches.
Spits– narrow projections of sand or shingle that are attached to the land at one end. They extend across a bay or estuary or where the coastline changes direction. They are formed by longshore drift powered by a strong prevailing wind.
Bars—form in the same way as spits, with longshore drift depositing material away from the coast until a long ridge is built up. However, bars grow right across the bay, cutting off the water to form a lagoon.



Exam questions:

1. Explain how a wave-cut platform is formed (4)
2. Briefly describe how spits are formed (2)
3. Explain the formation of a stack (6)
4. Explain how beaches are formed (4)

Erosional landform:

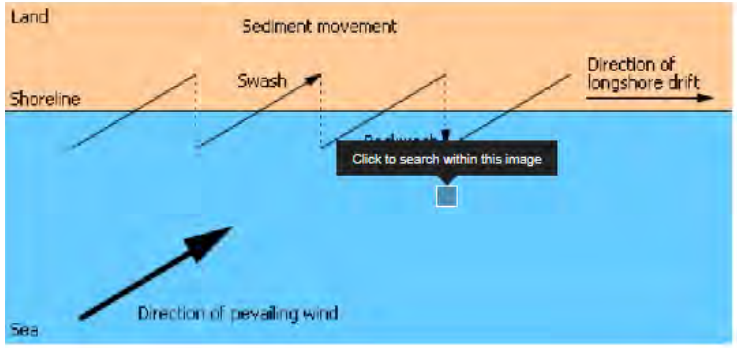
Wave-cut platform: A wave-cut notch is created when erosion occurs at the base of a cliff. As undercutting occurs the notch gets bigger. The rock will overhang the notch. The overhang will collapse and the cliff will retreat. This will create a wave-cut platform which is visible during low tide and submerged during high tide.

Transportation and deposition

Longshore drift— Waves approach the sea at an angle, swash pushes material up the beach at the same angle as the prevailing wind. Backwash carries the sediment back down the beach at a right angle due to gravity. This moves material along the coasts.
Traction– large boulders are rolled along the sea
Saltation—smaller stones are bounced along the sea floor.
Suspension—sand and small particles are carried along in the flow.
Solution—some minerals are dissolved in seawater.
Deposition - Waves drop the material it is carrying as it loses energy, it generally happens in sheltered areas such as bays, in calm conditions and with a gentle gradient.

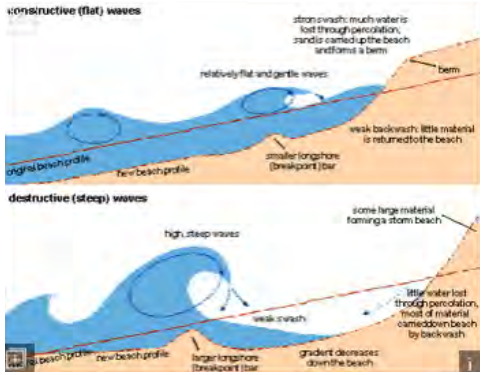
Exam questions:

1. Identify two landforms that are characteristic of discordant coasts (
2. Explain how the UKs climate contributes to coastal erosion (4)
3. Describe two ways in which waves erode a coast (2)
4. Explain how geological structure can influence the erosion of a coastal headland (4)
5. Explain the factors that lead to a fast rate of coastal retreat (4)
6. Draw a diagram to show the stages of freeze-thaw weathering (3)
7. Describe the differences between a constructive wave and destructive wave (4)
8. Explain the process of longshore drift (4)

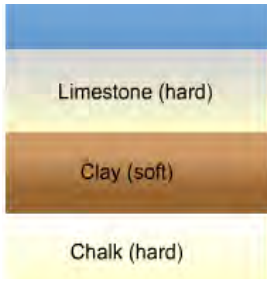


Types of waves:

Constructive waves— Have a strong swash and weak backwash, small waves under 1m high. Encourage deposition.
Destructive waves—Strong backwash, weak swash, taller than 1m. Encourage erosion.



Concordant and discordant coasts—
Concordant coasts are made up of the same rock type, parallel to the sea.
On discordant coasts have alternating rock types perpendicular to the sea forming headlands and bays.
Coastal retreat—when coasts move further in land as cliffs collapse into the sea due to erosion.



Rates of erosion:

This can be affected by: Geology, wave climate—fetch, direction, height, local currents and tidal range and groundwater levels—saturated cliffs are more vulnerable to erosion.

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 sea 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.

Four types of erosion:

Hydraulic action—the weight and impact of water against the coastline and cliffs erodes them.
Abrasion—breaking waves throw sand and pebbles against the coast during storms.
Attrition—rocks and pebbles collide.
Solution—chemical action by sea water, dissolves minerals in rocks.

Geology

The geological structure of coasts and the types of rock found there influence the erosion landscapes formed.
Soft rock— Easily eroded, cliffs will be less rugged and less steep. These landscapes include bays.
Hard rock—Resistant to erosion, cliffs are high and steep. These landscapes include wave-cut platforms, headlands, caves, arches and stacks.
Joins and faults—joints are small cracks in rock and faults are larger cracks in rocks. These both make rocks more susceptible to erosion. Rocks with more joints and faults are eroded quickly compared to rocks with few faults and joints.

Coastal flooding

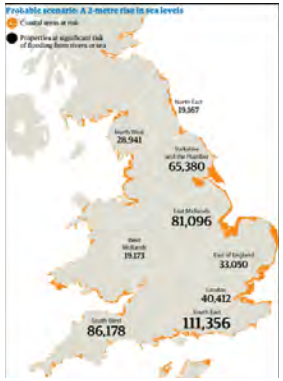
Climate change— As atmospheric temperature rises, it is likely the intensity and frequency of storms will increase. This will increase the height of the waves and when combined with high tides and rainfall will increase the risk of flooding and erosion.
As sea temperatures increase the water expands and sea levels rise. Added to this ice melting on land adds to the amount of water in the oceans and seas, therefore increasing the risk of flooding.

Impact of UK climate on erosion:

Seasons—colder seasons lead to more mechanical weathering, stormier seasons lead to more erosion and warmer seasons lead to more deposition.
Storm frequency– areas susceptible to strong storms are likely to suffer with more erosion.
Prevailing winds—mainly from the south-west bringing warm moist air and frequent rainfall, this leads to more weathering and erosion.

Coastal human activity and management

Human activities can have a positive or negative impact on coastal landscapes.
Development—the weight of buildings increases cliff collapse vulnerability, there is changes in drainage and increased cliff saturation leading to instability. However, it raises interests in protecting the areas.
Agriculture—increases soil erosion and sedimentation, although wildlife habitats can be created and preserved.
Industry– can cause air, soil and water pollution. It can destroy natural habitats for birds, animals and sea life. However, it improves the local economy.
Tourism—Increased development for hotels can increase erosion, increased pollution, increased revenue and desire to protect the environment.



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 - loosened rocks and soil suddenly tumble down the slope.
Slumping—happens when rock is saturated with water and slides down a curved slip plain.

Effects of flooding:

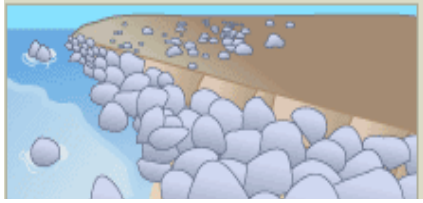
Erosion increases, depositional landforms destroyed, natural habitats damaged or destroyed, injury, death, psychological impacts, homes/settlements damaged or destroyed, loss of tourism, transport routes affected, loss of agriculture and lower economy.

Coastal management

Hard engineering—man made artificial structures that aim to protect.

Soft engineering—natural methods to protect the coast that work with the environment.

Rock armour or boulder barriers – large boulders are piled up on the beach and used to absorb the energy of waves and encourage the build up of beach material.



Advantages

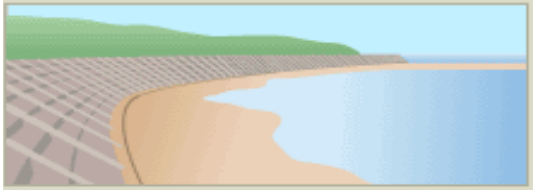
Absorb the energy of waves.

Allows the build up of a beach.

Disadvantages

Can be expensive to obtain and transport the boulders.

Building a sea wall



Advantages

Protects the base of cliffs against erosion. Can prevent coastal flooding in some areas.
Land and buildings are protected from erosion.

Disadvantages

A sea wall is expensive to build. Curved sea walls reflect the energy of waves back to the sea. This means that the waves remain powerful. Over time the wall may begin to erode. The cost of maintenance is high.

Building groynes – a wooden barrier built at right angles to the beach.

Advantages

Prevents the movement of beach material along the coast through the process of longshore drift.

Allows the build up of a beach (a natural defence against erosion and an attraction for tourists).

Disadvantages

Can be seen as unattractive.

Can be costly to build and maintain.

Exam questions

1. Describe two effects of human activity on coastal landscapes (2)
2. Explain one way in which agriculture affects coastal landscapes (2)
3. Explain how climate change may affect coasts in the future (4)
4. Explain why climate change brings an increased risk of coastal flooding in the UK (4)
5. Explain conflicting views on one method of coastal management (4)
6. Outline one cost and one benefit of one hard engineering method of coastal management (4)

Beach replenishment/ renewal	Beaches absorb wave energy (energy is spent moving sand and shingle up, down and along beaches). A wide beach is the best defence against coastal erosion. Sand and shingle can be added artificially to beaches to protect the coastline against erosion and/or flooding. Beach replenishment also maintains beaches for tourism.
'Do nothing' and managed realignment	It is too costly to build and maintain hard structures to defend the UK's entire coastline. Moreover, the costs of coastal defence will increase in future due to climate change and rising sea levels. This means that maintaining the UK's hard coastal defences is unsustainable. Where the value of threatened property is relatively low, erosion may be allowed to continue. 'Do nothing' is a controversial policy. It allows natural processes, such as the movement of sand and shingle, to operate, and it is sustainable. But people may lose their property without compensation. Managed realignment allows some stretches of coastline to be flooded, either by letting the sea breach flood embankments or by dismantling sea defences.This has already happened in parts of Essex and Lincolnshire. A new, sustainable coastline is established further inland. Managed realignment may result in loss of farmland, but flooded land becomes new salt marsh and mudflat — important habitats for wildlife.

Do nothing approach – let the sea erode the land
Managed retreat – allow the land to erode however, they give compensation
Hold the line – put in management strategies
Advance the line – create new land, this is unusual as expensive
Integrated coastal management – there is a move in recent year to manage the coast as a whole (holistic management), as actions in one area can have an impact elsewhere. This is because of sediment cells – these cells form the basis for shoreline management plans (SMP).