Coastal Landscapes and Processes

Glossary		Glossary	
Arch	A rock bridge formed when the sea erodes a hole all the way through a headland.	**Fault**	A fracture or break in rocks
Backwash	The movement of a wave down a beach, back to sea.	**Fetch**	The distance a wave has travelled towards the coastline over open water. The longer the fetch the more powerful the wave.
Bar	A ridge of sand or shingle (small stones and shells) across the entrance of a bay or river mouth.	**Geology**	The different types of rock that make up an area.
Bay	An area of sea, curved in shape which has been eroded between two headlands.	**Headland**	A steep sided cliff area of more resistant rock jutting out into the sea.
Beach	A sloping area of sand or pebbles between the low and high water marks. It is formed when material eroded elsewhere is deposited along the coastline.	**Landscape**	An area with unique features that make it look different from surrounding areas (e.g. a coastline or an area of forest).
Berm	A ridge of sediment found towards the back of a beach.	**Longshore drift**	The zig-zag motion in which material is transported along a beach by wave action.
Cave	A hollow at the base of a cliff which has been eroded by the waves.	**Mass Movement**	The movement of material down a slope due to gravity.
Constructive wave	A gently breaking wave with a strong wash and a weak backwash. It adds more material to the beach than it removes.	**Prevailing wind**	The direction in which the wind blows most frequently.
Coast	Land bordering sea.	**Sediment**	Material such as mud, sand and pebbles carried by a wave.
Deposition	A physical process where rocks and material are dropped by the waves that carry them.	**Spit**	A ridge of sand or single deposited by the sea. It is attached to the land at one end, the other extended into the sea.
Destructive wave	A strong wave with a weak swash and strong backwash that removes material from the coastline.	**Stack**	An isolated column of rock, found at the end of a headland.
Erosion	A physical process which involves the wearing away and removal of material by a wave or river.	**Stump**	A short piece of rock found at the end of a headland formed after a stack has collapsed.

Glossary	
Swash	The movement of a wave as it approaches the beach.
Transportation	A physical process in which material is moved from one place to another.
Wave cut notch	A small indentation at the base of a cliff formed where wave action is greatest.
Wave cut platform	A flat area of rock at the base of a cliff seen at a low tide. It is where the cliff used to be.
Weathering	The breakdown of rocks by natural processes. It occurs in situ – without moving.

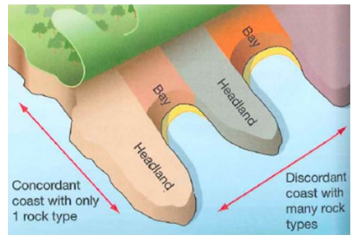
Geology

Different rock types have varying degrees of resistance to physical processes (weathering and erosion).

Sedimentary	Rocks such as clay and sandstone are less resistant to physical processes, however chalk is more resistant.
Igneous	Rock such as granite and basalt are very resistant to physical processes.
Metamorphic	Rocks such as slate and schist, tend to be more resistant than sedimentary rocks.

Types of Coastline

Concordant	Coastline with bands of more resistant and less resistant rocks run parallel to the coastline. E.g. Lulworth Cove.
Discordant	Coastline with bands of more resistant and less resistant rock run perpendicular (at right angles) to the coastline. Headlands and bays form here. E.g. Swanage Bay.



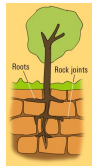
Waves

Waves are created by wind blowing over the sea. Friction with the surface of the water causes ripples to form, which grow into waves.

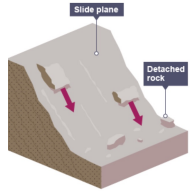
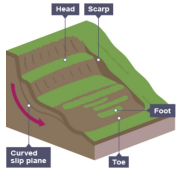
Factors affecting wave size	
1.	The speed of the wind - a faster speed means bigger waves.
2.	Wind duration -the longer the wind has been blowing, the bigger the wave.
3.	The fetch of the wind. The greater the fetch, the bigger the wave.

Characteristics of types of waves	
Constructive	Destructive
• Low wave height (<1m) • Long wavelength • Low frequency (<10 per minute) • Low energy • Flat beach gradient • Depositional • Stronger swash, weak backwash.	• High wave height (>1m) • Short wavelength • Higher frequency (>10 per minute) • High energy • Steep beach gradient • Erosional • Weak swash, stronger backwash.

Weathering

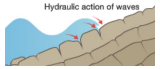
Biological	Plant roots or seeds can find their way into cracks in the rock. As the plant grows, the rock is forced apart.	
Chemical	Rainwater dissolves some rocks (especially limestone and chalk) when it is acidic.	
Physical	Rainwater enters the rock and freezes when temperatures drop at night. In the day, the ice thaws and more water can flow into the space. As the process repeats, pieces of rock breaks off.	

Mass Movement

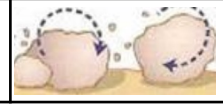
Rockfall	Pieces of rock fall off the cliff face, usually due to freeze-thaw weathering.	
Landslide	Large volumes of material moves downhill very rapidly, in a straight line, along a joint in the rock.	
Slumping	Saturated soil or rock, collapses in a rotational movement, down a curved slope.	

Coastal Landscapes and Processes

Erosional Processes

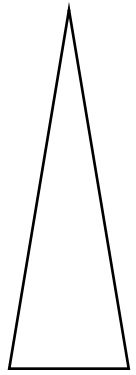
Hydraulic Action	This is the sheer power of the waves as they smash against the cliff. Air becomes trapped in the cracks in the rock and causes the rock to break apart	
Abrasion	This is when pebbles grind along a rock platform, much like sandpaper. Over time the rock becomes smooth.	
Attrition	This is when rocks that the sea is carrying knock against each other. They break apart to become smaller and more rounded.	
Solution	This is when sea water dissolves certain types of rocks. In the UK, chalk and limestone cliffs are prone to this type of erosion.	

Transport Processes

Solution	When minerals in rocks like chalk and limestone are dissolved in sea water and then carried in solution. The load is not visible.	
Suspension	Small particles such as silts and clays are suspended in the flow of the water.	
Saltation	Where small pieces of shingle or large sand grains are bounced along the sea bed.	
Traction	Where pebbles and larger material are rolled along the seabed.	

Size of Material

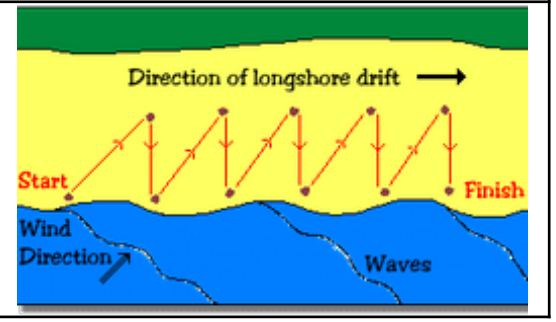
Smallest



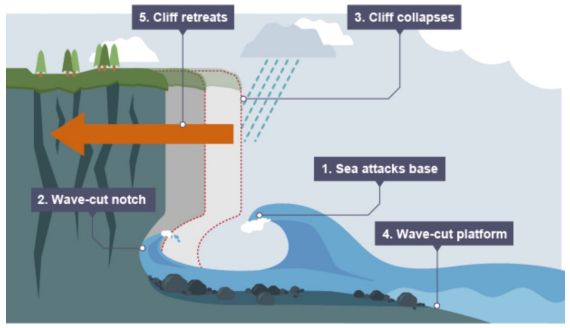
Largest

Transport Processes – Longshore Drift

- Material moves along the coastline by a process called **longshore drift.**
- Waves approach the coast at an angle because of the direction of prevailing wind.
- The **swash** will carry the material towards the beach at an angle.
- The **backwash** then carries material down the slope of the beach at right angles, back towards the sea.
- Over time, the process repeats and material moves in a zig-zag motion along the coast.



Erosional Landform – Wave Cut Platform



1.The sea attacks the base of the cliff between the high and low water mark.

2.A **wave-cut notch** is formed by erosional processes such as abrasion and hydraulic action - this is a dent in the cliff usually at the level of high tide.

3.As the notch increases in size, the cliff becomes unstable and collapses, leading to the retreat of the cliff face.

4.The backwash carries away the eroded material, leaving a **wave - cut platform.** A flat area of rock at the base of the cliff seen at a low tide.

5.The process repeats. The cliff continues to retreat.

Erosional Landform – Caves, Arches, Stacks and Stumps

1.Cracks and **faults** are widened in the headland through the erosional processes of hydraulic action and abrasion.

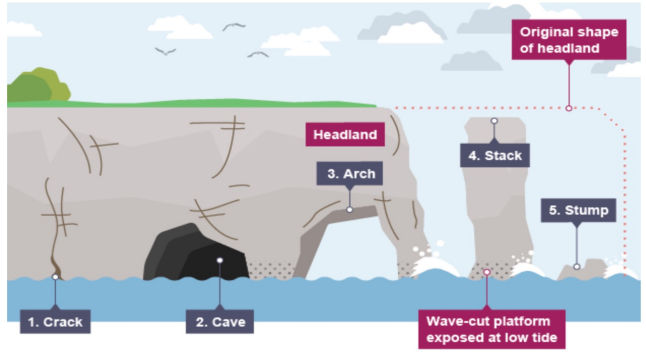
2. As the waves continue to grind away at the crack, it begins to open up to form a **cave**.

3.The cave becomes larger and eventually breaks through the headland to form an **arch**.

4.The base of the arch continually becomes wider through further erosion, until its roof becomes too heavy and collapses into the sea.

5.This leaves a **stack** (an isolated column of rock).

6. The stack is undercut at the base until it collapses to form a **stump**.



Erosional landform – Headland and Bays

Headlands and bays form along discordant coastlines. The less resistant rock (e.g. clay) is eroded quickly and this forms a bay. The more resistant rock (e.g. chalk) is eroded slower and sticks out into the sea, forming a headland.

Deposition

Factors leading to deposition:	
	waves starting to slow down and lose energy.
	sheltered areas, e.g. bays.
	little or no wind.
	shallow water.

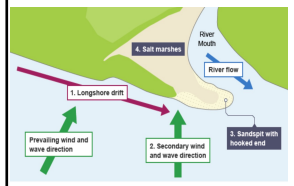
Deposition landform - Formation of a Spit

1. Sediment is carried by **longshore drift**.
2. When there is a change in the shape of the coastline, **deposition** occurs.
3. A long thin ridge of material is deposited. This is the spit.
4. A hooked end can form if there is a change in wind direction.
5. Waves cannot get past a spit, therefore the water behind a spit is very sheltered. **Silts** are deposited here to form salt marshes or mud flats.

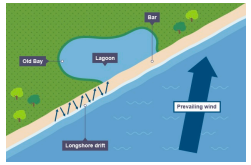
Depositional Landforms

Beaches are made up from eroded material that has been transported from elsewhere and then deposited by the sea.

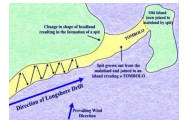
A **spit** is an extended stretch of sand or shingle jutting out into the sea from the land. Spits occur when there is a change in the shape of the landscape or there is a river mouth. (see formation of Spit box)



Sometimes a spit can grow across a bay to join two **headlands** together. This landform is known as a **bar**. Bars can trap shallow lakes behind the bar - these are known as lagoons.



A **tombolo** is a spit. connecting an island to the mainland



Coastal Landscapes and Processes

Tier 3 vocabulary	
Coastal recession (retreat)	The gradual movement backwards of the coastline.
Coastal flooding	The inundation of land close to the sea by seawater.
Storm surge	A sudden rise in sea level during a storm event. The storms produce strong winds that push huge volumes of water into shore, which can lead to coastal flooding.
Soft-engineering	A method of coastal management which works or attempts to work with the natural processes occurring on the coastline. It seeks to change the land in a more environmentally sustainable way.
Hard-engineering	A method of coastal management which involves major construction – the building of artificial defences, usually out of concrete to interrupt natural processes.

Impacts of coastal flooding and recession		
Coastal flooding	Social	Disruption to gas and electricity supplies. Transport networks destroyed.
	Environmental	Crops ruined by sea water. Trees and vegetation washed away. Forming of new habitats due to inundation of flood water.
Coastal recession	Social	Decreasing value of properties and difficulty obtaining insurance. Loss of businesses (farmland, caravan parks, cafes, golf courses) from disappearing cliffs.
	Environmental	Wildlife habitats destroyed.

Environmental Agency coastal management strategies	
Strategy	**Description**
No intervention	No planned investment in defending against flooding or erosion.
Hold the line	Maintain the existing shoreline by building defences.
Managed re-alignment	Allow the shoreline to change naturally, but oversee and direct the process.
Advance the line	Build new defences on the seaward side.

Coastal Defences

	Sea defence	Description	How it works	Advantages	Disadvantages
Hard-engineering	Seawall	Curved concrete walls built at the base of the cliff.	Deflects the waves back out to sea.	Effective at protecting cliff base for many years. Promenades for people to walk along.	Expensive to build – approx. £6,000 per metre. Visually displeasing. Can make beach inaccessible.
	Rock armour (Rip-rap)	Large igneous boulders piled at the base of the cliff.	Absorbs the energy of the wave.	Effective protection for many years. Relatively cheap and easy to maintain.	Boulders are expensive to transport. Can make beach inaccessible. Boulders look different to local geology.
	Groynes	Wooden (or rock) structures built at right angles to the beach.	Traps sediment to broaden the beach. The built up beach will then absorb wave energy. Prevents longshore drift.	Quick to construct. Makes the beach wider, which can attract more tourists.	Interrupts the movement of sediment along the coast and deprives beaches further along the coast of sand, making them narrower. Rock groynes can be unsightly.
	Offshore reefs	Blocks of concrete, natural boulders or even old tyres that are sunk offshore.	Offshore reefs alter wave direction and dissipate wave energy. Interferes with longshore drift.	They allow the build-up of sand to occur because they reduce wave energy.	Difficult to install. Expensive to build – approx. £2, 000 per metre.
Soft-engineering	Beach nourishment	Sand or shingle is added to the beach to make it wider.	The beach can absorb more wave energy and protect the coastline.	Provides beach for tourists. Looks natural and is aesthetically pleasing.	Requires constant maintenance as material is washed away, which can become costly.
	Managed retreat	Controlled flooding of low-lying coastal areas of low value e.g. farmland.	Reduces the volume of water available to flood other built up areas of land containing buildings and houses.	Low cost strategy. Creates a salt marsh which can encourage wildlife.	Land is lost as it is reclaimed by the sea. Landowners need to be compensated – approx. £5,000- £10,000 per hectare.