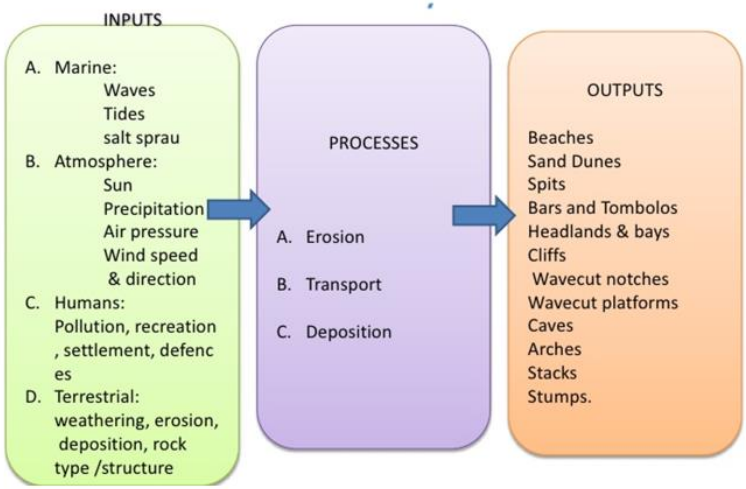
Subject	Geography	**Year Group**	12	**Sequence No.**	1	**Topic**	Hazards

Retrieval	Core Knowledge	Student Thinking
What do teachers need retrieve from students before they start teaching new content?	What specific ambitious knowledge do teachers need teach students in this sequence of learning?	What real life examples can be applied to this sequence of learning to development of our students thinking, encouraging them to see the inequalities around them and 'do something about them!'

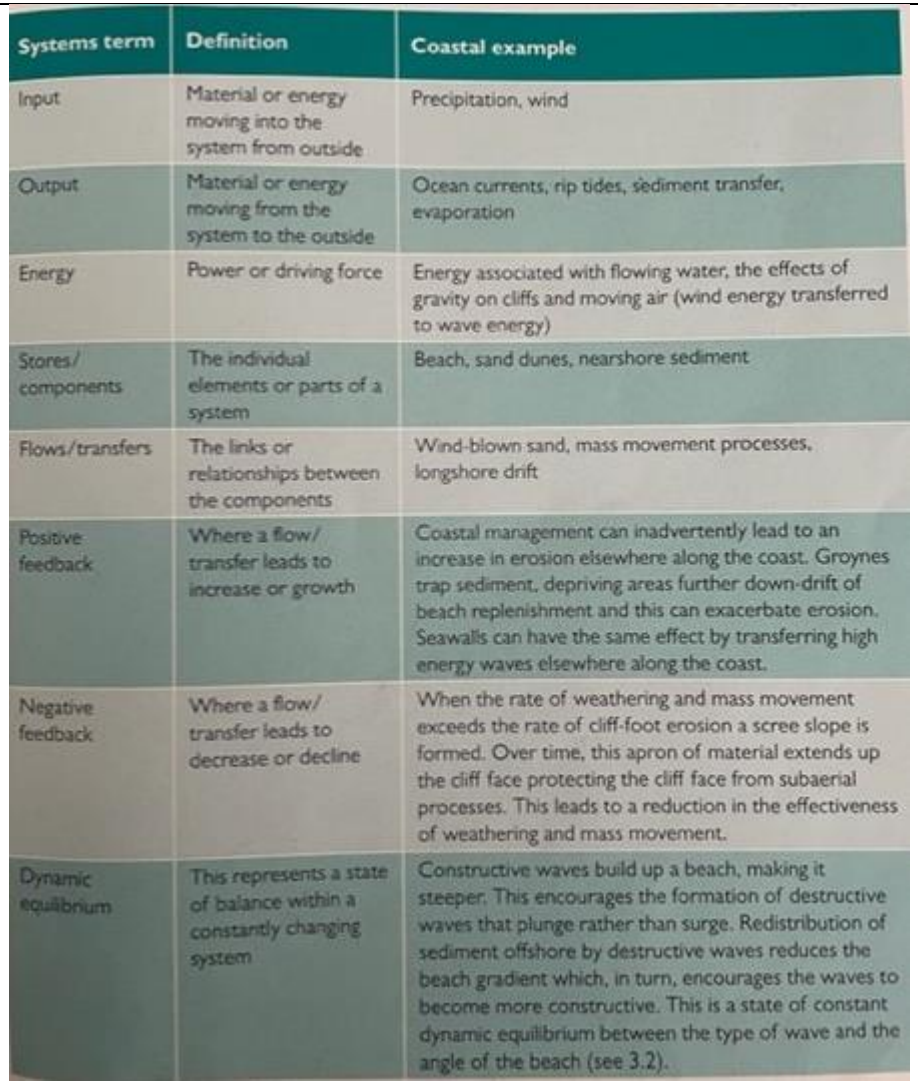
Each lesson starts with recap linked to prior learning From GCSE retrieve constructive and destructive waves When teaching about sediment cells and budgets retrieve the idea of a coastal system, from earlier in the topic From GCSE retrieve the 3 types of weathering; mechanical, biological and chemical When teaching about weathering and mass movement refer back to the concepts of positive and negative feedback From GCSE and KS3 river retrieve the different coastal processes From GCSE Coasts retrieve the coastal landforms associated with erosion and deposition	**<u>Coastal system</u>** • The coast as an open system • The coast is an example of an open system. • As an open system, the coast has important links with other natural • systems such as the atmosphere (consider the importance of wind. for example, in generating waves), tectonics, ecosystems and oceanic systems. • These natural systems are linked together by flows of energy and by the transfer of material.  In common with other natural systems it is useful to apply systems terminology to help us to understand the connections between processes and landforms	From the knowledge gained in this topic students will understand how coastal processes help to create the landforms we see along the coast. Students will explore how problems associated with coastal erosion can be combated. They will also look into a career they could have linked to the knowledge acquired. They will develop and understanding of the systems theory and how humans can alter this both positively and negatively. They will do this through the following activities: • Make decisions on linked to different types of human activity is good or bad for the coastal system • Discuss how human interactions can impact the equilibrium of the coastal system • Decide what coastal management strategies are most or least effective • Residential trip to Dorset to see landforms, processes and management • Assess how effective SMPs and ICZM schemes are • Investigate into sediment cells • Problem solving linked to coastal management

From GCSE retrieve the various hard and soft engineering strategies used to manage coastlines

When teachings about SMPs refer back to sediment cells from earlier in this topic

From Y9 coasts topic discuss human impacts on coastal environments

From Human geography side of the course link to how a coastline can be an endogenous factor of importance. Also, consider how human interventions along the coast can impact the character of the place



Systems term	Definition	Coastal example
Input	Material or energy moving into the system from outside	Precipitation, wind
Output	Material or energy moving from the system to the outside	Ocean currents, rip tides, sediment transfer, evaporation
Energy	Power or driving force	Energy associated with flowing water, the effects of gravity on cliffs and moving air (wind energy transferred to wave energy)
Stores/ components	The individual elements or parts of a system	Beach, sand dunes, nearshore sediment
Flows/transfers	The links or relationships between the components	Wind-blown sand, mass movement processes, longshore drift
Positive feedback	Where a flow/ transfer leads to increase or growth	Coastal management can inadvertently lead to an increase in erosion elsewhere along the coast. Groynes trap sediment, depriving areas further down-drift of beach replenishment and this can exacerbate erosion. Seawalls can have the same effect by transferring high energy waves elsewhere along the coast.
Negative feedback	Where a flow/ transfer leads to decrease or decline	When the rate of weathering and mass movement exceeds the rate of cliff-foot erosion a scree slope is formed. Over time, this apron of material extends up the cliff face protecting the cliff face from subaerial processes. This leads to a reduction in the effectiveness of weathering and mass movement.
Dynamic equilibrium	This represents a state of balance within a constantly changing system	Constructive waves build up a beach, making it steeper. This encourages the formation of destructive waves that plunge rather than surge. Redistribution of sediment offshore by destructive waves reduces the beach gradient which, in turn, encourages the waves to become more constructive. This is a state of constant dynamic equilibrium between the type of wave and the angle of the beach (see 3.2).

<u>Waves</u>

Waves are most commonly caused by wind. Wind-driven waves, or surface waves, are created by the friction between wind and surface water. As wind blows across the surface of the ocean or a lake, the continual disturbance creates a wave crest.

Various factors influence waves

- Wind strength

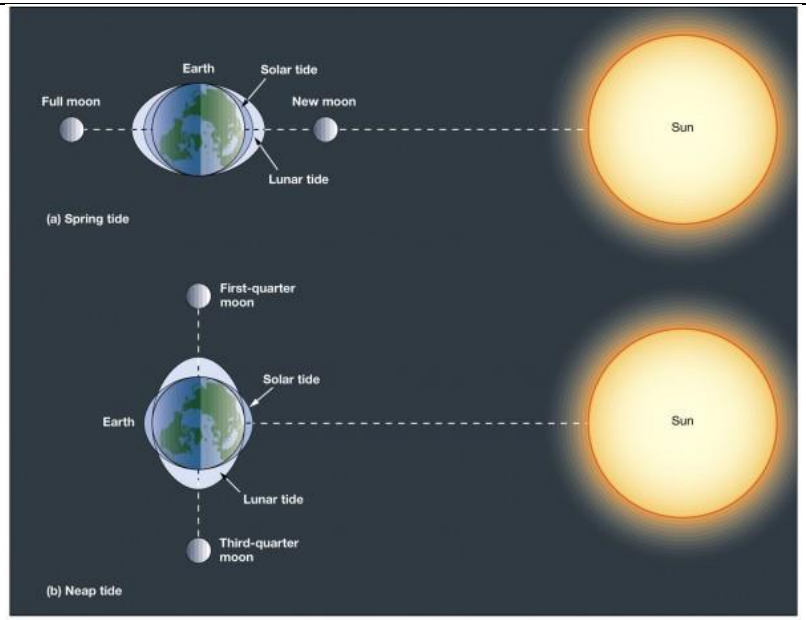
- Look at coastlines they have visited and identify processes, landforms and management

- Duration of wind
- Fetch

	Characteristic	
Distant weather systems generate these waves in the open ocean	Formation	Local storms are responsible for these waves
Low, surging waves – with a long wavelength	Wave form	High, plunging waves – with a short wavelength
Strong swash, weak backwash	Wave break	Weak swash, strong backwash
Beach gain (constructive)	Beach gain/loss	Beach loss (destructive)
Usually associated with a gentle beach profile – although, over time, they will build up the beach and make it steeper	Beach profile	Usually associated with a steeper beach profile – although, over time, they will flatten the beach

Tides

- Tides are linked to changes in the water level
- They are caused by gravitational pull from the moon
- Larger tidal range during a spring tide compared to neap tide



Rip Currents

- Strong local/small scale underwater currents
- Occur on some beaches
- Dangerous
- Caused when plunging waves lead to a build of water at the top of a beach
- This forces the backwash below the surface of the water

High and low energy coastlines

High Energy Coastlines

- Rocky coasts are generally found in high energy environments. These tend to be
- Stretches of the Atlantic-facing coasts, where the waves are powerful (large fetch) for most of the year (Cornwall and NW-Scotland)
- Where the rate of erosion exceeds the rate of deposition
- Landforms include headlands, cliffs, shoreline platforms (wave-cut platforms)

Low Energy Coastlines

- Sandy and estuarine coasts are generally found in low-energy environments. In the UK these tend to be
- Stretches of the coast where the waves are less powerful or where the coast is sheltered from large waves (such as Lincolnshire and Norfolk)Where the rate of deposition exceeds the rate of erosion.
- Many coasts are a mixture of high and low energy environments. For example, while Holderness may be predominately low-energy, winter storms can still create a short term high-energy erosional environment.
- Also, local geology can also create headlands (such as the chalky cliffs of Flamborough head)

Wave refraction

Wave refraction involves waves breaking onto an irregularly shaped coastline, e.g. a headland separated by two bays. Waves drag in the shallow water approaching a headland so the wave becomes high, steep and short. The part of the wave in the deeper water moves forward faster causing the wave to bend.

Sources of sediment

Rivers
Cliff erosion
Longshore drift
Wind
Glaciers
Offshore

Sediment cells

A sediment cell is a stretch of coastline, usually bordered by two prominent headlands, where the movement of sediment is more or less contained.
systems diagram, with inputs (sources), transfers (flows) and stores (sinks).
• Inputs (sources) - these are primarily derived from the river, coastal erosion and offshore sources, such as bars or banks.
• Transfers (flows) - these involve longshore (littoral) drift together with onshore and offshore processes such as rip currents.

- Stores (sinks) - these include the beach, sand dunes and offshore deposits (bands and bars).

Sediment budget

- Material in a sediment cell can be considered in the form of a sediment budget, with losses and gains.
- Losses from the system involve deposition in sediment sinks, whereas gains tend to involve coastal erosion or sediment brought into the system by rivers or from offshore sources. In principle, the sediment budget seeks to achieve a state of dynamic equilibrium where erosion and deposition are balanced.
- This balance can be upset by events, such as a surge in river discharge following floods introducing vast amounts of sediment into the system.
- This, in turn, leads to deposition in the river estuary. A severe storm might also upset the balance by eroding a beach and transferrin,
- sediment outside the system.

Weathering

- Mechanical weathering-salt crystallization, wetting and drying
- Chemical-oxidation and carbonation
- If the rate of removal exceeds the rate of weathering positive feedback occurs
- If the rate of removal is slow negative feedback takes place
- Weathering leads to mass movement

Mass Movement

- Downhill movement of material influenced by gravity
- Linked to weight of rainwater and weak geology
- Mass movement is an input into the coastal system
- Soil creep-Moves slowly, in a zig zag shape, due to mechanical weathering
- Mud flows-Often occurs after heavy rainfall, permeability, sudden and fast flowing
- Landslide-blocks of rock moving rapidly downhill-caused by earthquakes or heavy rainfall
- Slumping-similar to landslide but the cliff curved rather than flat
- Rockfall-breaking of individual rock fragments linked to mechanical weathering
- Solifluction-similar to soil creep but happens in cold periglacial landscapes

Coastal/marine erosion

Wave quarrying-waves scoop up loose material
Corrasion-Pebbles and rocks hurled against cliff face
Abrasion-sandpapering effect of material against the cliff face
Factors affecting coastal erosion

- Waves
- Lithology (rock type)
- Geological structure (cracks and joints)
- Beach
- Sub aerial processes-weathering and mass movement
- Coastal management

Coastal landforms

Tombolo
A tombolo is a beach (or ridge of sand and shingle) that has formed between a small island and the mainland. Deposition occurs where waves lose their energy and the tombolo begins to build up. Tombolos may be covered at high tide, for example, at
Offshore bars
Also known as sandbars, offshore bars are submerged (or partly exposed) ridges of sand or coarse sediment created by waves offshore from the coast. Destructive waves erode sand from the beach with their strong backwash and deposit it offshore.
Offshore bars act as both sediment sinks and, Potentially, sediment input stores. They can absorb wave energy thereby reducing the impacts of waves on the coastline.

Sea level change

Eustatic-
This is when the water level rises or falls.
Its global.
Warm periods it increases due to melt ice caps
Cold periods it leads to water freezing meaning a drop
Isostatic
This is when the land rises and falls
Its more localized
During ice ages the land sinks due to the weight of the ice on land

	During interglacial periods land rebounds/rises as the weight of ice is removed due to melting **Tectonic-** Uplift of mountain ranges and coastal land at destructive margins and tilting land. **Emergent Landforms** • Emergent landforms begin to appear towards the end of an ice age and they occur when isostatic rebound takes place faster than a eustatic rise in sea level. • The land's height rises faster than the sea's. • Emergent features are features of coastal erosion that appear to have developed well above the current sea level. They developed when the sea was at that level and then the sea level changed during and ice age and now they're above sea level. • Raised beaches are wave-cut platforms & beaches that are above the current sea level. You can normally find some old cliffs (relic cliffs) too behind these raised beaches with wave-cut notches, arches, stacks etc. along them. • These emergent features no longer experience coastal erosion but they are still weathered, often being weathered biologically, chemically and via freeze-thaw weathering. **Submergent Landforms** • Submergent landforms are the opposite of emergent landforms. • They form when the eustatic rise in sea level takes place faster than the isostatic rebound after an ice age. • Water starts to flood the land and fills up landforms on the land. • Ria-This is a river valley that's been flooded by the eustatic rise in sea level. They're almost exactly like a typical river valley but they have even more water in them. The cross section of a ria is really similar to the one you'd find for a river in the lower course. One thing to note, the floodplain of the river also gets flooded, altering the cross profile of a ria ever so slightly so that it includes the floodplain. • Fjord- These are steeper and deeper variants of riases that are relatively narrow for their size. They have a u-shaped cross profile and are often found in particularly icy sections of the world. • Fjords are really deep however they have a shallow mouth (known as a threshold) as this is where the glacier deposited its load. • Dalmatian coastline. These form in areas of the world where valleys (especially glacial valleys) lie parallel to each other.	

	• When the valleys are flooded by the rise in sea level, the tops of the valleys remain above the surface of the sea and appear to be a series of islands that run parallel to the coastline. **<u>Contemporary sea level change</u>** • Sea levels are still rising. • We're still coming out of our last ice age (amazingly, isostatic rebound is still taking place) and ice from the last ice age is still melting. • The planet's getting hotter which is melting even more ice on top of the ice that was already defrosting from the last ice age. **<u>Shoreline management plans</u>** • Each sediment cell has its own SMP-treated as a closed cell • SMP identify natural processes, human activities and management decisions • Self contained within the sediment cell • Don't have knock on effects in other areas • Focus on; hold the line, advance the line, managed retreat, do nothing **<u>Integrated coastal management</u>** • Aim is to bring all stakeholders together • Establish sustainable levels of economic and social activity as well as resolve environmental, social and economic issues whilst protecting the coast • Rather than individual areas being managed whole stretches of coastline are-so that a strategy in one place doesn't impact another • Holistic approach See text book and lesson powerpoints for the Holderness and Odisha case studies	