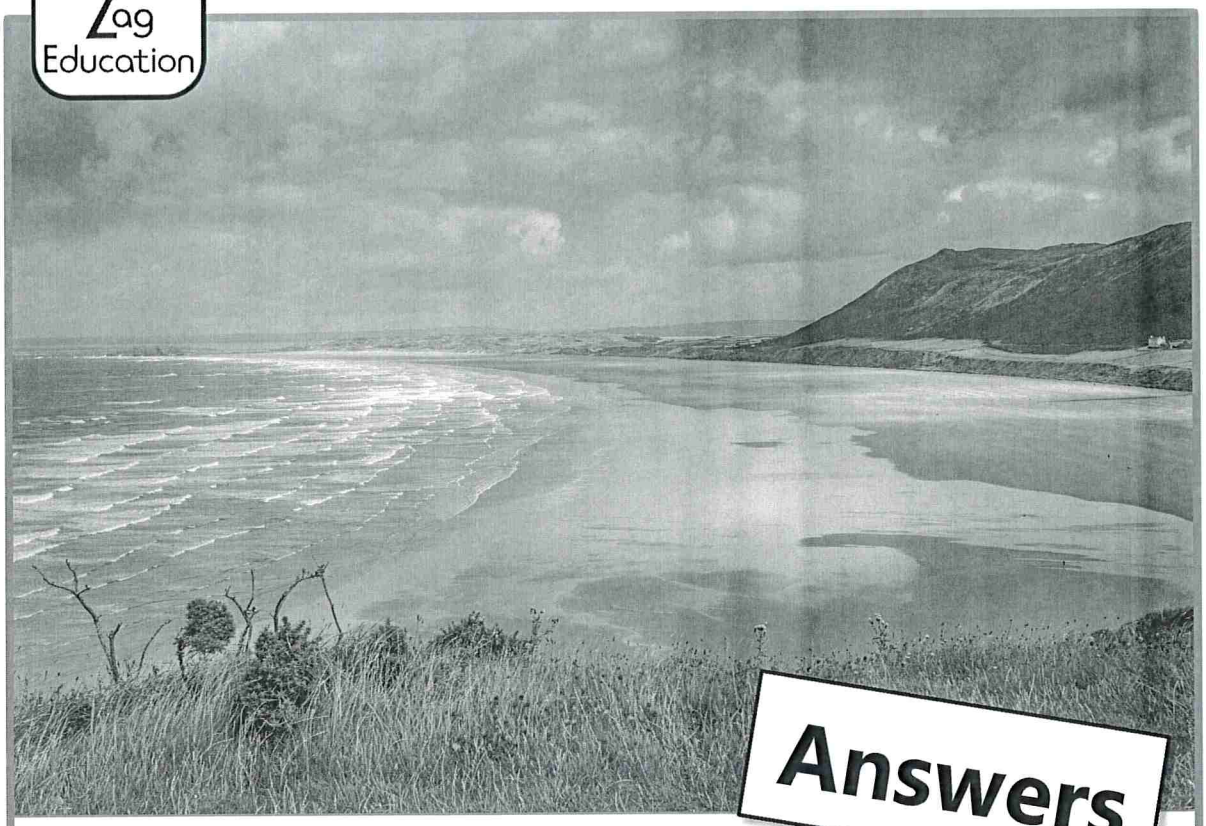
Zig Zag Education



Answers

Learning Grids

for A Level AQA Geography

Component 1: Physical Geography

Section B: Coastal Systems and Landscapes

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POD 9099b

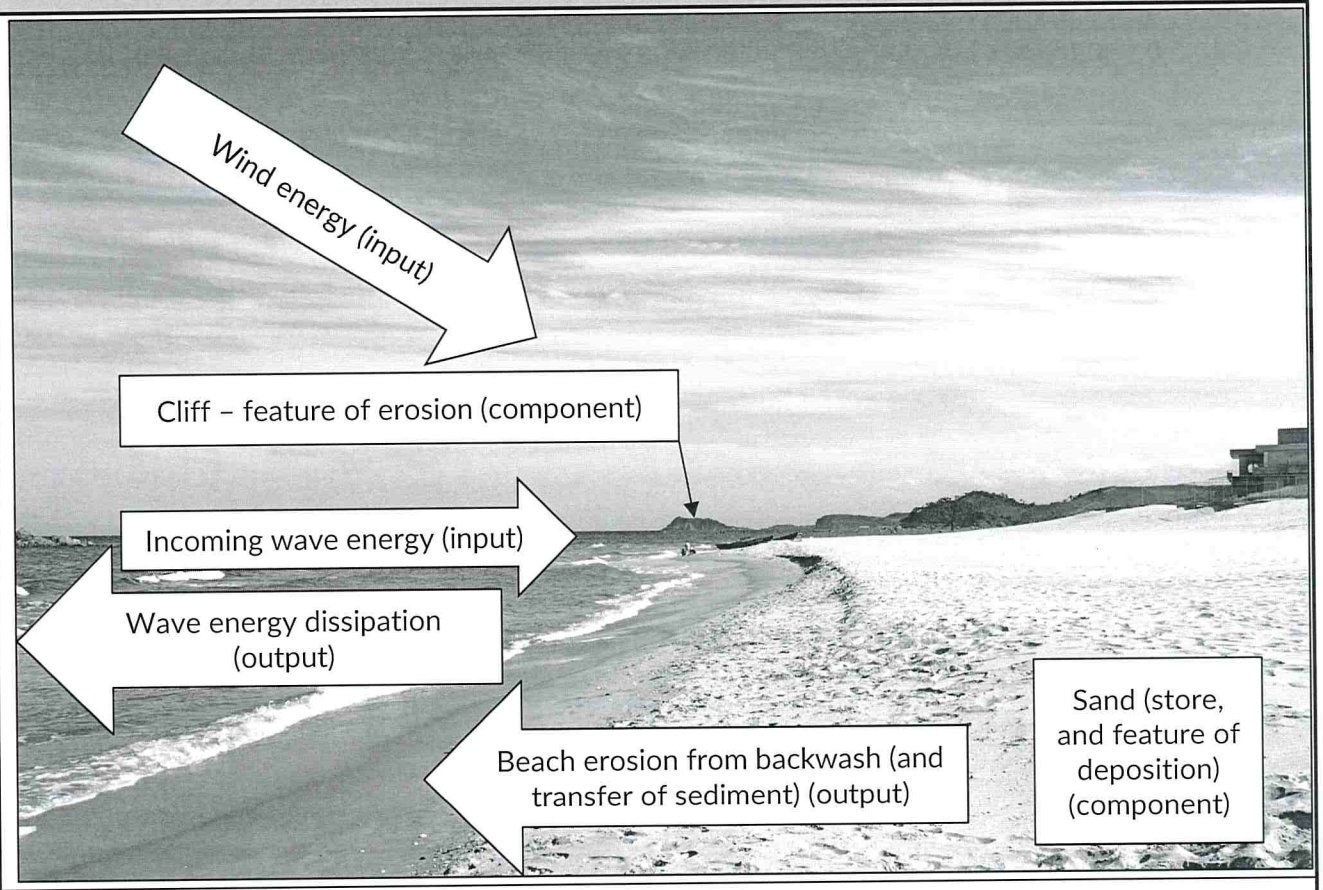
Learning Grid 1: Natural Systems

HOD: pp. 89–91
CAM: pp. 66–69
ZZ-RP: pp. 2–5

<table>
<tr><th colspan="3">Question</th><th colspan="2">Answer</th></tr>
<tr><td rowspan="11">What are natural systems?</td><td>1</td><td>What is a 'natural system'?</td><td colspan="2">A model for the transfer of material and/or energy into a cycle. Flows and processes occur within the system to produce landforms, and sometimes material and/or energy is removed from the cycle. Within the system, a state of equilibrium exists, feedback cycles return a system back towards equilibrium (-ve) or push a cycle away from equilibrium (+ve).</td></tr>
<tr><td rowspan="9">2</td><td rowspan="9">A system can be thought of as consisting of inputs, processes, components, stores, transfers or flows, and outputs. Decide which best describes each item in the table opposite.</td><td>Item</td><td>Input, process, component, store, transfer/flow or output?</td></tr>
<tr><td>Land-derived sediment</td><td>Input</td></tr>
<tr><td>Landforms of erosion and deposition</td><td>Component</td></tr>
<tr><td>Wind transport</td><td>Process</td></tr>
<tr><td>Beach sand and shingle</td><td>Store</td></tr>
<tr><td>Lost wave energy</td><td>Output</td></tr>
<tr><td>Sediment moved above the tidal limit</td><td>Output</td></tr>
<tr><td>Energy from waves/wind/tides/currents</td><td>Input</td></tr>
<tr><td>Movement of energy or material through the system</td><td>Transfer/flow</td></tr>
<tr><td>Longshore drift</td><td>Process</td></tr>
<tr><td>3</td><td>Why are the 'relationships' between different parts of a system?</td><td colspan="2">There are various determinants on a system, some of which depend on each other. For example, the speed of erosion is determined by the hardness of the rock, or the amount of energy which enters the system.</td></tr>
</table>

		Question	Answer	
What are natural systems?	4	**What is the name for the edge of a system?**	Boundary	
	5	**Provide descriptions of the following three types of system.**	**1. Open system**	Transfer of energy and material in and out of the system.
			2. Closed system	Only transfer of energy in and out of the system (material can enter, but not leave).
			3. Isolated system	No transfer of energy or material in and out of the system.
	6	**Which type of system is a coastal system? Briefly explain your choice.**	The coastal system is an **open system**. Inputs and outputs of energy and material occur.	
Equilibrium and feedback	7	**What is meant by the term 'dynamic equilibrium'?**	The inputs and outputs of a system are the same.	
	8	**What is feedback?**	A change which causes a move towards or away from the equilibrium.	
	9	**Feedback can be positive or negative.** **Circle the description of 'negative feedback'.**	**A change which shifts the system away from equilibrium**	**A change which restores a system back towards equilibrium.**
	10	**Give an example of each type of feedback which might occur in the coastal zone.**	**Positive feedback**	For example: Increasing erosion of a dune slack. Allow any suitable examples.
			Negative feedback	For example: Increase in beach steepness due to calm weather (increased destructive waves); however, increased backwash removes the sediment and the beach profile is restored. Increased storminess removes sediment from a beach, and an offshore bar is formed. This means that the bar dissipates energy, and constructive waves restore the beach.

Question			Answer		
Equilibrium and feedback	11	**Give two factors which determine dynamic equilibrium.**	**1.**	Changes in energy and material inputs, e.g. weather conditions (sun, rain, storms, etc.), types of wave, inputs of material from rivers, erosion.	
			2.	Sea level.	
Components and landforms	12	**There are four major Earth subsystems. Name them. The component is named on the right.**	**1.**	Atmosphere	**Air**
			2.	Hydrosphere	**Water**
			3.	Lithosphere	**Rock**
			4.	Biosphere	**The living world**
	13	**Give an example of how these subsystems are linked to form 'cascading systems'.**	Allow any relevant example, such as: • Vegetation linked to CO_2 concentration of the atmosphere and, therefore, temperature, rainfall and weathering. • Water erosion by rivers and sea, or wind erosion (aeolian) acting on the lithosphere. • Biological weathering of rock.		

	Question		Answer
Components and landforms	14	**Label the photograph with the inputs, components, transfers and outputs.**	
	15	**What is the difference between a landform and a landscape?**	A landform is a small-scale feature, such as a beach, a cliff or an arch. A landscape is a collection of features.

Learning Grid 2a: Coastal Systems

HOD: pp. 91–97
CAM: pp. 70–74
ZZ-RP: pp. 9–16

The coastal zone

1

Arrange the coastal zones in order from furthest from shore to closest to shore:

inshore, backshore, offshore, foreshore

Furthest from shore:	1. Offshore
↕	2. Inshore
	3. Foreshore
Closest to shore:	4. Backshore

2

Decide which coastal zone is being described by each statement in the table opposite.

Statement	Zone
This zone is entirely landward of the high-water mark under normal conditions.	Backshore
This zone covers all areas below the low-water mark where waves still impact on the underlying land.	Nearshore
Changes take place in this zone only during storms.	Backshore
Sediment deposition is the only activity in this zone.	Offshore
Under normal conditions, this is the most important zone for marine processes.	Nearshore
This zone covers all areas where waves no longer impact on the underlying seabed.	Offshore

3

The nearshore is divided into three zones. Name each zone, 1 being closest to the land.

1.	Swash zone
2.	Surf zone
3.	Breaker zone

		Question	Answer
Energy sources in the coastal zone	4	**Wind is the main energy source in coastal environments because it forms waves. How are waves formed?**	Wind blows across the sea, causing friction. The waves move towards the land. In deep water, the waves are small, but at the coast, the seabed slows the bottom of the wave (when the depth of the water is less than one wavelength deep), so the wave becomes more elongated, before steepening and collapsing.
	5	**What is 'fetch'?**	The distance of water that the wind has blown across.
	6	**Using the map, identify the areas of the world with the greatest fetch.**	 Pacific and Atlantic coasts of North and South America, Pacific coast of Asia, eastern and western coasts of Africa, western coast of the UK, France and Portugal.
	7	**How does wind energy impact coastlines? (excluding the direct action of waves)**	Creation of depositional features such as dunes, and abrasion (aeolian).

	Question		Answer	
Energy sources in the coastal zone	8	**What three parameters control how much energy a wave gains?**	**1.**	Wind speed.
			2.	Duration of windy conditions.
			3.	The distance over which wind and water are in contact (the fetch).
	9	**Name and describe the movement of waves up and down the beach.**	Swash: Water that rushes up the beach in an onshore direction after a wave breaks – this pushes the material towards the shore. Backwash: Water running back down the beach in an offshore direction due to the pull of gravity – can erode the sand and gravel back towards the sea.	
	10	**What are tides, and why do they occur?**	**Tides are...**	the daily rising and falling sea level variations
			Tides occur because...	of the gravitational pull of the Moon and, to a lesser extent, that of the Sun on the oceans
	11	**Explain how this process leads to high and low tides.**	The gravitational pull of the Moon attracts water on Earth to swell in towards it – creating a high tide. A second high tide is created on the opposite side of the Earth, where water also swells. Between these swells, where water has drained away, are areas of low tide.	
	12	**Explain how the tidal range influences the rate of coastal erosion.**	The tidal range determines the vertical extent of the area that will be attacked, and subsequently eroded, by wave action. It can also affect the size of the area that will be subject to subaerial weathering during periods of low tide.	
	13	**What meteorological factors combine to create high sea levels during a storm surge?**	Storm surges are created during depression weather systems. As air pressure is very low during depressions, the sea level rises relative to normal, higher pressure conditions. In addition, depressions create stormy weather and strong winds. These strong winds create large waves that exacerbate the already elevated sea levels.	

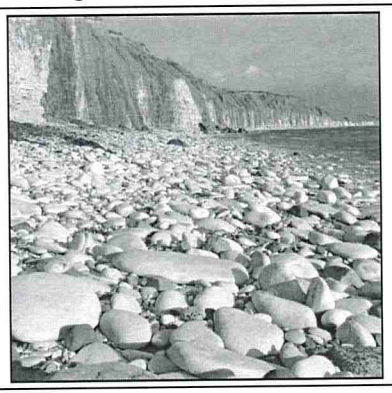
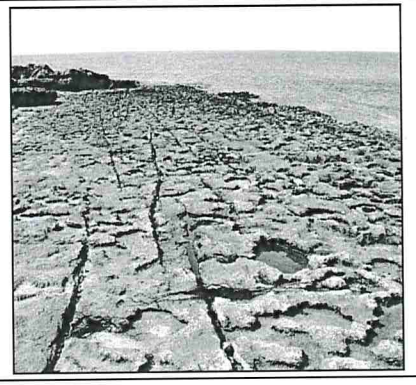
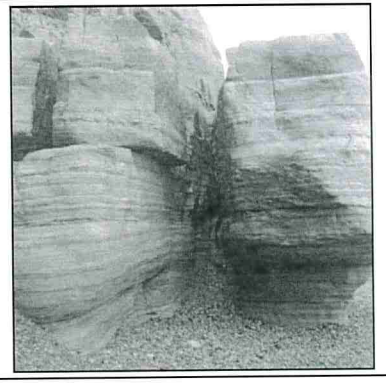
	Question		Answer						
High-energy and low-energy coastlines	14	**Do constructive waves or destructive waves lead to beach erosion?**	Destructive waves.						
	15	**For each characteristic listed opposite, a pair of descriptions is provided. Decide which description best suits constructive and destructive waves by placing a 'C' or 'D' beside each description. The first has been done for you.**	**Wave height:**		**High**	D		**Low**	C
			Wavelength:		**Long**	C		**Short**	D
			Wave steepness:		**High**	D		**Low**	C
			Swash strength:		**Strong**	C		**Weak**	D
			Backwash strength:		**Strong**	D		**Weak**	C
			Resulting material motion:		**Offshore**	D		**Up-beach**	C
			Resulting beach profile:		**Steep**	D		**Shallow**	C
	16	**Is the beach pictured opposite the result of constructive or destructive waves? Justify your answer.**	 **Constructive or destructive?** Constructive. **Justification:** The beach is very shallow, which is characteristic of beaches resulting from constructive waves, as these waves continually move material in an up-beach direction. In fact, this up-beach motion of material causes the coastline-parallel ridges seen in the picture.						

	Question		Answer	
High-energy and low-energy coastlines	17	**What is a high-energy coastline?**	A coastline along which wave power is usually strong.	
	18	**What types of environment are likely to be low-energy environments?**	Sheltered environments such as estuaries, inlets, bays and enclosed seas.	
	19	**What happens to transported material in such low-energy environments?**	Material is deposited.	
Sediment cells and budgets	20	**What is a cell, in the context of sediment movement?**	A cell is a self-contained section of coastline along which sediment is input, transported and output without impacting upon neighbouring cells.	
	21	**What type of feature typically separates adjacent sediment cells?**	Headlands or areas of deep water.	
	22	**Give two inputs of material in the coastal zone.**	**1.**	From the land – rivers, cliffs, etc.
			2.	Offshore – from the seabed, ocean currents, etc.
	23	**What is the coastal sediment budget?**	The balance between the inputs and outputs in a coastal system, specifically relating to sediment cells.	
	24	**Complete the following sentences:**	**A positive budget occurs when material is added to a sediment cell faster than it is lost. Therefore, the shoreline** extends outwards into the water. **A negative budget occurs when more material is removed from the cell than is gained, meaning that** beaches become thinner, and coastal retreat may occur.	

Learning Grid 2b: Coastal Processes

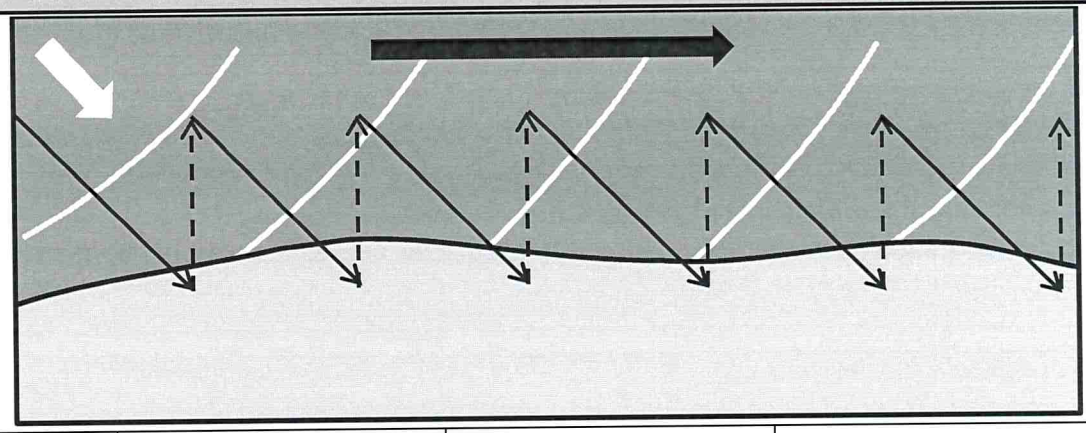
HOD: pp. 97–103
CAM: pp. 74–78
ZZ-RP: pp. 9–16

		Question	Answer	
Weathering	1	**What is a 'subaerial' process?**	A process that occurs on land rather than in the sea (meaning 'under air').	
	2	**Give an example of each of the three main types of subaerial weathering process that occur in coastal environments.**	**1. Physical**	Freeze-thaw, pressure release, heating and cooling cycles, etc. Allow technical names such as onion skin, exfoliation, etc.
			2. Chemical	Carbonation, hydration, oxidation, hydrolysis, etc. Allow references to acid rain.
			3. Biological	Include burrowing animals, root action, and the secretion of acids by living organisms.
Mass movement	3	**What are the four main types of sudden, mass-movement processes acting in coastal environments?**	**1.**	Rockfalls
			2.	Landslides
			3.	Earthflows and mudflows
			4.	Slumps
	4	**Do such mass-movement processes normally take place on steep-gradient or shallow-gradient coastlines?**	Steep-gradient coastlines.	
	5	**What is a mudflow?**	A mudflow is a downhill movement of unconsolidated sediment, normally caused by rainfall.	
	6	**What hydrological conditions are needed for slumping to occur?**	The slumping rock layer must be full of water, to lubricate the slump. Thus slumping normally occurs during or after periods of prolonged precipitation, e.g. prolonged rainfall, or a number of high tides.	

<table>
<tr><th colspan="3">Question</th><th colspan="3">Answer</th></tr>
<tr><td rowspan="3">Mass movement</td><td>7</td><td>What shape is the slide plane in a slump?</td><td colspan="3">A curved, concave surface.</td></tr>
<tr><td>8</td><td>Which type of mass movement occurs very slowly?</td><td colspan="3">Soil creep.</td></tr>
<tr><td>9</td><td>How does run-off contribute to the coastal system?</td><td colspan="3">Run-off inputs sediment into the coastal system, particularly during times of flood. Additionally, run-off can act to erode the parts of the coastline that lie alongside channels.</td></tr>
<tr><td rowspan="2">Erosion</td><td>10</td><td>Which important marine erosion process is being described by each statement in the table opposite?</td><td colspan="3"><table><tr><th>Statement</th><th>Process</th></tr><tr><td>Rocks are worn down into smaller, increasingly rounded pieces.</td><td>Attrition</td></tr><tr><td>Water compresses air in gaps in a rock face, creating high pressures that can cause rocks to break.</td><td>Hydraulic action</td></tr><tr><td>Soluble rocks, such as limestone, are dissolved by seawater chemicals.</td><td>Solution/corrosion</td></tr><tr><td>Material being transported in the sea grinds against rock, causing erosion.</td><td>Abrasion/corrasion</td></tr></table></td></tr>
<tr><td>11</td><td>Which of the main processes of marine erosion have acted on the rocks shown in each of the following photographs?</td><td> 
Process:
Attrition</td><td> 
Process:
Solution/corrosion</td><td> 
Process 1:
Hydraulic action

Process 2:
Abrasion/corrasion</td></tr>
</table>

		Question	Answer
Erosion	12	**What natural factors influence the coastal erosion rate?**	The characteristics of waves that affect the coast, the coastal geometry, the nature of any beach present and the local geology all influence the rate of coastal erosion.
	13	**Describe the characteristics of a wave that has high erosive power.**	A steep, high-energy wave that breaks close to the shore.
	14	**Explain how differential erosion shapes concordant and discordant coastlines.**	Rocks of different hardness erode at different rates – harder rocks will erode slowly compared to softer rocks. Bands of different rock can run either parallel to the shoreline, or at right angles. The speed of the erosion influences the shape of the coastline, e.g. headlands and bays in discordant coastlines, and coves in concordant coastlines.
Transport	15	**Match up the following types of transport to their definitions. They are ordered from largest material to smallest material.**	**Traction** → **Material is bounced along the seabed.** **Saltation** → **Material is supported within the water, which can make the water appear cloudy.** **Suspension** → **Material is dissolved.** **Solution** → **Material is rolled across the seabed.**
	16	**Explain the process of longshore drift.**	Waves approaching the shore at an angle push rock material up the beach in the direction of wave approach. The backwash from these waves follows the direction of maximum slope, which is normally oriented at 90° to the coastline, moving rock material back out to sea. With time, this pattern of swash and backwash carries sediment along the coast, sometimes over long distances.

		Question	Answer
Transport	17	**Match the symbols in the legend to the correct terms using the numbers provided.**	

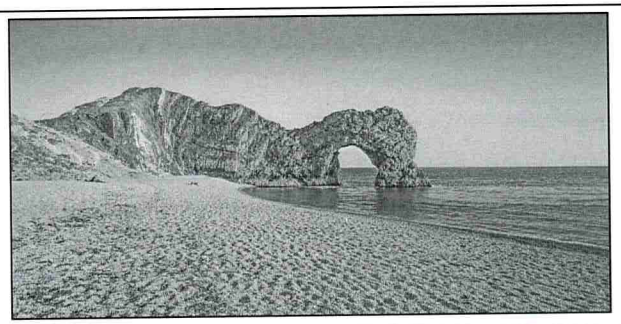
A		Swash direction
B		Direction of longshore drift
C		Backwash direction
D		Wave direction

	18	**What is a rip current?**	Fast, offshore movements of water.
Deposition	19	**Under what conditions does coastal deposition occur?**	Coastal deposition occurs when solid materials accumulate more rapidly than they are removed. This may be due to low erosion rates associated with low wave energy, or due to high rates of sediment supply, for instance from rapid coastal erosion occurring nearby. Deposition can also occur when friction is increased.
	20	**In terms of particle size, which particles are deposited <u>first</u>? Circle the correct answer.**	**Smallest** / **Largest**
	21	**Explain how the wind can transport and deposit material.**	The wind can transport dry sand. The wind can blow sand on a beach, through saltation and creep. Sand is deposited where it is slowed down at the back of the beach, e.g. where it encounters obstacles, to form dunes.

Learning Grid 3: Landforms of Erosion

HOD: pp. 103–105
CAM: pp. 97–80
ZZ-RP: pp. 19–22

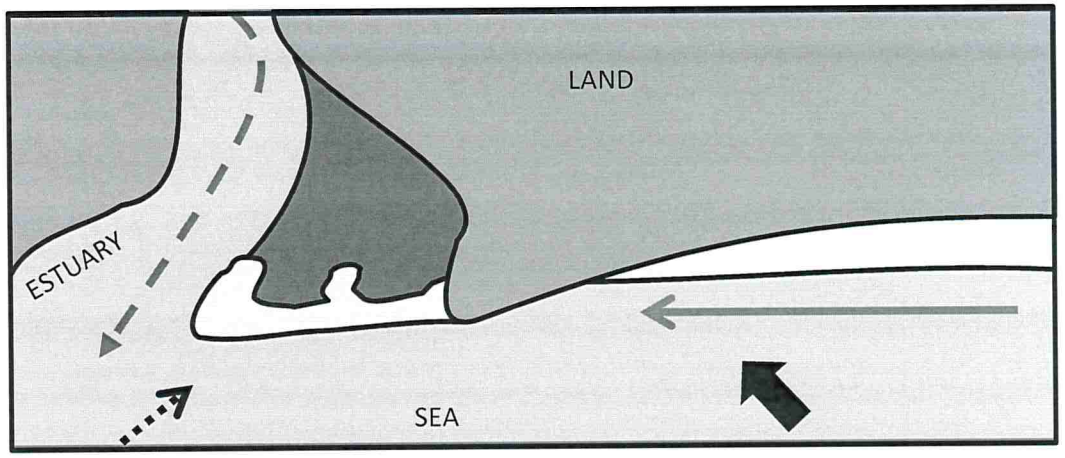
	Question		Answer	
Headlands and wave-cut platforms	1	**Give two erosional processes which lead to the formation of cliffs.**	**1.**	Cliffs are eroded at the top due to subaerial processes such as weathering and mass movement.
			2.	The bases of cliffs are eroded due to contact with seawater, e.g. abrasion, hydraulic action, to form notches. When undercutting is sufficient, the material above can collapse.
	2	**How does rock type affect the shape of cliffs?**	Harder rocks will often form high, vertical cliffs, while softer rocks and unconsolidated material, such as boulder clay, are more likely to form slumping cliffs. There are other factors involved, such as the dip of the rocks, and the amount of fracturing.	
	3	**When layers of resistant rock and less-resistant rock alternate along a coast, which landforms are formed by the following?**	**1. The resistant rock**	Headlands
			2. The less-resistant rock	Bays
	4	**Why do headlands receive the highest-energy waves? Does this lead to erosion or deposition?**	Headlands receive the highest-energy waves due to wave refraction. This means that headlands are normally subject to increased levels of erosion.	
	5	**What near-coast process bends waves in a coast-parallel direction?**	Wave refraction.	
	6	**Explain how this process works.**	Parts of the wave in the shallowest water (e.g. near headlands) are slowed more than those in deeper water (e.g. in bays), causing waves to bend in a coast-parallel direction.	
	7	**On a concordant coastline, which features form instead of bays?**	Coves.	
	8	**How are wave-cut platforms linked to cliffs?**	Wave-cut platforms are formed as a cliff retreats due to undercutting and collapse, leaving a slightly sloping rocky platform behind. The surface may become smooth if it is scoured by pebbles.	
	9	**How can wave-cut platforms reduce the rate of coastal erosion (retreat)?**	They absorb energy (because the waves break further from the cliffs).	

	Question		Answer	
Stacks, arches, stumps and caves	10	**Place the list of landforms opposite in order of formation during progressive erosion of a coastline, from earliest to latest.**	**1.**	Cave
			2.	Arch
			3.	Stack
			4.	Stump
			Stack, Arch, Stump, Cave	
	11	**Identify the processes of erosion that are involved in the creation of this sequence.**	Allow any suitable descriptions of the processes – for example, cracks and fissures can be created through hydraulic action and can be widened through abrasion and other erosive forces. Rock in contact with the seawater will also be susceptible to solution. **Also allow reference to subaerial processes which may affect the rocks, such as the varying forms of chemical weathering.**	
	12	**What type of landform is shown in the photograph opposite? How does such a feature form?**		**Landform:** Arch. **Formation:** An arch forms when a cave erodes all the way through a headland.
	13	**How does a stack form?**	A stack forms when further erosion causes the roof of an arch to collapse.	
	14	**What is a geo? How does a geo form?**	A geo is a narrow inlet with vertical walls. A geo forms when there is a pre-existing weakness such as a crack, which is widened by erosion.	
	15	**How does a blowhole form?**	A blowhole forms when erosion within a cave occurs in an upwards direction along a weakness in the rock, or when the roof of a cave collapses. These processes extend the cave to the surface, forming a blowhole.	

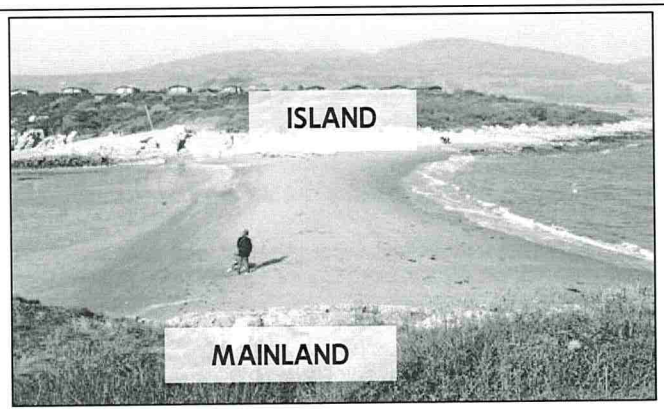
Learning Grid 4: Landforms of Deposition

HOD: pp. 106–112
CAM: pp. 81–85
ZZ-RP: pp. 25–29

		Question	Answer
Beaches	1	**Why are sandy beaches normally gently graded?**	Sandy beaches are gently graded because wet sand compresses, preventing swash from percolating into the beach. This means that almost all of the water arriving as swash returns as backwash, causing sand to be carried down the beach towards the sea.
	2	**Why are beaches that are formed of coarser material normally steeper?**	Water arriving on the beach as swash is able to efficiently permeate through a beach formed of larger grain sizes, leading to a much reduced backwash which is unable to transport beach material out to sea.
	3	**What is a storm beach?**	A storm beach is an accumulation of the largest material deposited onto the land during high spring tides and storm events.
	4	**What are berms? What do they represent?**	Berms are ridges of deposited material built up on the beach at the high-tide mark. Berms form in a series that represents successive high-tide marks, as the high-tide level recedes between spring tide and neap tide.
	5	**Where do cusps form?**	Cusps form where waves break directly onto a beach, leading to strong swash and backwash. They usually only develop where sandy and shingle beaches meet.

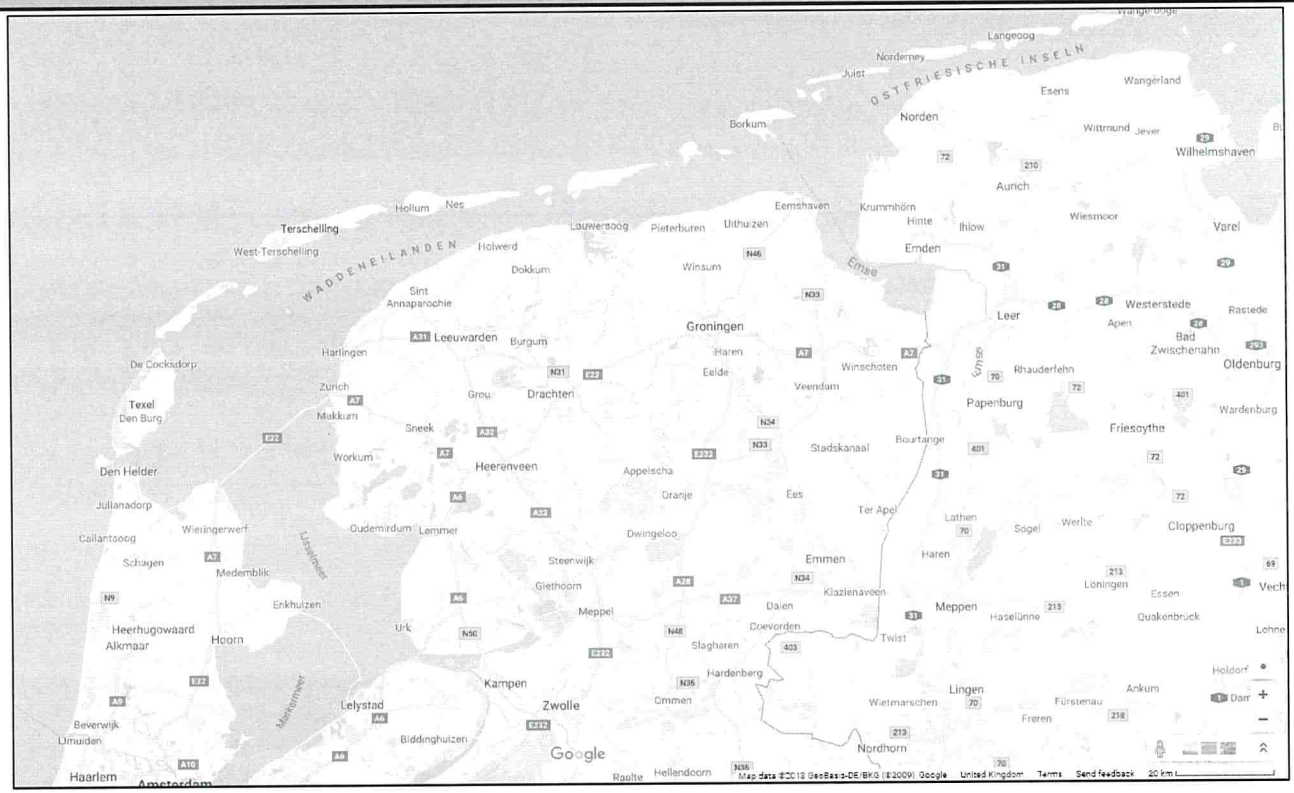
	Question		Answer
Spits, bars and tombolos	6	**What is a spit?**	A spit is a long, narrow depositional feature composed of sand and shingle which projects out from a headland into an estuary or the sea.
	7	**The sketch opposite shows the formation of a spit. Complete the legend by identifying each of the processes shown by the arrows on the sketch.**	
	8	**Briefly describe how a spit forms using the image above. Include in your answer a discussion of the controls on the geometry of a spit.**	Material is carried along a coastline by longshore drift until the coastline makes a sharp change in direction around a headland. When this occurs the transported material gets deposited in the low-energy environment found in the sheltered area behind the headland, forming new land. With time, this depositional feature extends out from the headland to form a long, thin spit. The spit begins to curve due to the action of wave refraction, possibly coupled with the action of a secondary wind direction. If a spit grows into an estuary, its length is limited by the location of the high-energy river current which causes material to be transported out to sea.

LEGEND			
	Fastest river current		Secondary winds
	Longshore drift		Prevailing winds

	Question		Answer	
Spits, bars and tombolos	9	**Does the spit in the diagram show a 'simple spit' or a 'compound spit'?** **Explain your choice.**	**Type of spit:**	Compound spit.
			Explanation:	There are several 'hooks', which could mark the position of the end of the spit at an earlier stage of development.
	10	**What is a bar?**	A bar is a spit which crosses an entire bay from one side to the other.	
	11	**When can a bar form?**	When there is no significant water from the land (i.e. a river) to stop continued sedimentation and spit growth.	
	12	**Decide whether each image opposite depicts a bar or a tombolo. Place an 'X' in the correct boxes.**		

Bar	
Tombolo	X

Bar	X
Tombolo	

		Question	Answer
Spits, bars and tombolos	13	**What is the name of the chain of islands shown on the map?** **Explain which type of ecosystem may be located behind the island chain.**	 **Map data © 2018 GeoBasis-DE/BKG (© 2009), Google** **Name of islands:** Barrier islands. **Type of ecosystem (and why):** Allow salt marshes or mudflats. The area of water behind the islands is protected, meaning that the water behind is slow-moving. The energy of the water is reduced, meaning that less material can be suspended.

	Question		Answer	
Sand dunes	14	**What is a sand dune?**	A sand dune is a depositional feature in which sand, blown from a beach by onshore winds, is shaped into rises.	
	15	**What transport process moves sand from beaches into dunes?**	Saltation.	
	16	**Why do coastal winds normally blow in an inland direction (from the beach to the dunes)?**	Daytime insolation causes the land to heat more than the sea. Air rises above the land, leading to slightly lower pressure conditions than are found in the air above the cool sea. This pressure difference causes wind to move in a landward direction at ground level.	
	17	**Place the dune types listed opposite in order of development (this is also the order from coastal to inland).**	***Dune ridge, climax vegetation, embryo dune, foredune, dune heath***	
			1.	Embryo dune
			2.	Foredune
			3.	Dune ridge
			4.	Dune heath
			5	Climax vegetation
	18	**Decide which dune type is being described by each statement in the table.**	**Statement**	**Dune type**
			Dunes that have grown upwards above the reach of most storm tides.	Foredunes
			The first dunes to develop; these are low and hummocky.	Embryo dunes
			These dunes develop a nutrient- and water-rich organic layer, and become more permanent features.	Fixed dunes
			These dunes are initially yellow due to a lack of organic matter.	Foredunes
			Dunes of this type in the UK will be covered in woodland.	Climax

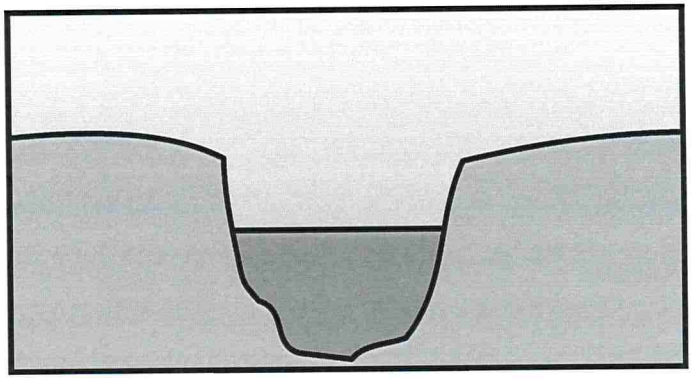
	Question		Answer	
Salt marshes and mudflats	19	What is a salt marsh?	A salt marsh is an intertidal mudflat, as deposited by rivers or gentle tides, upon which vegetation has developed.	
	20	Where do salt marshes form?	Salt marshes form in sheltered, low-energy environments such as behind spits or in estuaries.	
	21	What is the name of a succession that develops in salt marshes?	Halosere.	
	22	What must a plant species be able to tolerate if it is to be a pioneer in a salt marsh environment?	**1.**	A high salinity environment.
			2.	Periodic influx of seawater.
	23	How do pioneers alter the salt marsh, allowing further colonisation?	Pioneers develop a layer of vegetation which covers the saline mud, allowing colonisation by different species.	
	24	Why do salt marshes rise in height?	The roots and stems of plants cause more sediment to be deposited. Over time, the marsh is raised up.	
	25	What is the difference between a salt marsh and a mudflat?	A salt marsh is covered in vegetation, while a mudflat is likely to be devoid of vegetation.	

Learning Grid 5: Sea Level and Climate Change

HOD: pp. 112–116
CAM: pp. 86–92
ZZ-RP: pp. 33–38

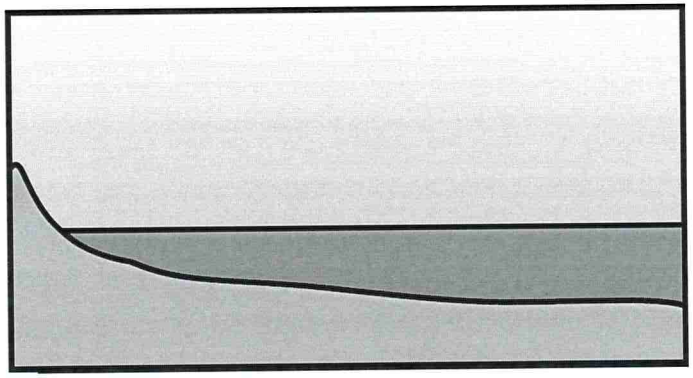
<table>
<tr><th colspan="3">Question</th><th colspan="3">Answer</th></tr>
<tr><td rowspan="5">Eustatic, isostatic and tectonic change</td><td rowspan="2">1</td><td rowspan="2">Describe how and why sea level has changed over the last 10,000 years.</td><td>How?</td><td colspan="2">Sea level has increased by approximately 60 metres. Most of this rise occurred early on; most of the change had already occurred 7,000 years ago.</td></tr>
<tr><td>Why?</td><td colspan="2">During the last ice age, ocean levels fell because water from the oceans became land ice. As the climate warmed, the land ice melted and the water flowed back into the oceans.</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">Briefly define eustatic and isostatic sea level change.</td><td>Eustatic:</td><td colspan="2">A change in sea level that affects the whole planet, caused by changes in the volume of water stored in the oceans.</td></tr>
<tr><td>Isostatic:</td><td colspan="2">A localised sea level change caused by changes in the level of the land relative to a fixed sea level.</td></tr>
<tr><td>3</td><td>Sea level change occurred during the last glaciation. For each statement in the table, decide whether localised sea levels would 'rise' or 'fall', and whether the sea level change is 'eustatic' or 'isostatic'.</td><td colspan="3"><table>
<tr><th>Statement</th><th>Rise or fall?</th><th>Eustatic or isostatic?</th></tr>
<tr><td>As the climate cools, increasing amounts of water are stored as ice and snow.</td><td>Fall</td><td>Eustatic</td></tr>
<tr><td>The weight of ice causes the land to sink in some areas.</td><td>Rise</td><td>Isostatic</td></tr>
<tr><td>The climate warms, melting ice and snow.</td><td>Rise</td><td>Eustatic</td></tr>
<tr><td>Land begins to rebound now that the weight of the ice has been removed.</td><td>Fall</td><td>Isostatic</td></tr>
</table></td></tr>
</table>

		Question	Answer
Eustatic, isostatic and tectonic change	4	**How can tectonic changes affect the volume of the oceans?**	The shape of the seafloor can change slightly – such as through the creation of ocean ridges and trenches. Increases in ocean ridges will cause sea level to rise. Conversely, the volume of the oceans can expand, decreasing sea level. This can occur as continents collide (land height increases).
	5	**What is the term for when the surface height of a land mass rebounds following ice melting?**	Isostatic readjustment.
	6	**How is the above process affecting the UK presently?**	The UK is still adjusting following the melting of the last ice sheet. The land is rising in north-west Scotland, where the ice sheet was thickest and where the ice melted most recently.
	7	**How could the sea level in a certain area fall at the same time as the global sea level is rising?**	If the local rate of isostatic sea level fall (related to rising land surface) is more rapid than the global rate of sea level rise (related to increased oceanic water volume), then the local sea level will show a net fall relative to the land surface.
Emergent and submergent features	8	**Sea level was once higher in some areas relative to the land than it is today. This has resulted in 'relict features' – landforms that are no longer affected by coastal processes. Name one of these features.**	A raised beach (or marine platform), or relict cliff.
	9	**If the sea levels have risen, how are such features possible?**	Isostatic changes – the height of the land – e.g. in Scotland.
	10	**What is a ria?**	A ria is a river valley, or a system of river valleys, that is flooded during sea level rise.
	11	**What is a fjord?**	A fjord is a glacial valley that has been flooded during sea level rise.

	Question		Answer
Emergent and submergent features	12	**Decide whether each sketch is a cross profile or a long profile, and whether the sketch depicts features typical of a ria or a fjord. Put an 'X' in the relevant boxes.**	

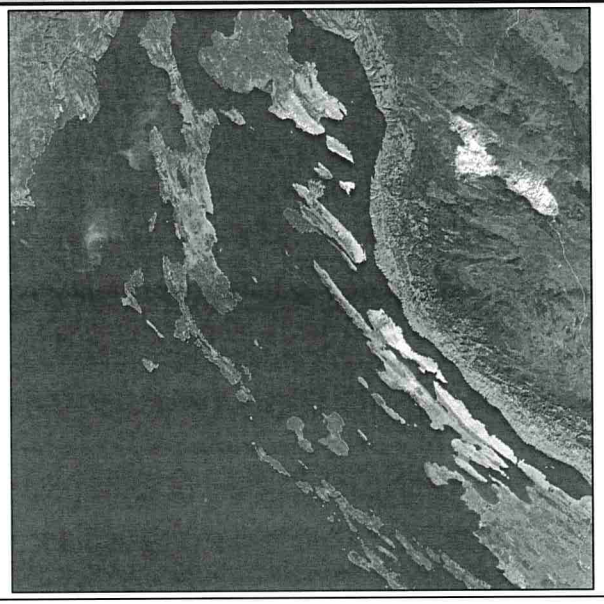
Cross profile	X
Long profile	

Ria	
Fjord	X



Cross profile	
Long profile	X

Ria	X
Fjord	

		Question	Answer	
Emergent and submergent features	13	**Study the aerial photograph. Identify the type of coast, and explain how it was formed.**		
			Type:	Dalmatian coast.
			Formation:	The former valleys ran in parallel to the coast before they were flooded. This is the opposite direction to rias and fjords.
Sea level rise	14	**How has sea level changed more recently (in the last 100 years), and how might sea level change over the next century?**	Sea level increased in the twentieth century by just under 2 mm per year. This is increasing each year, and will likely further increase into the future. Allow any suitable estimates of rise per year, and also the overall rise in terms of by set decades or dates.	
	15	**Mean global temperatures are currently rising. In what way is this likely to affect the sea level?**	Temperature increases will lead to the melting of ice currently held in the Greenland and Antarctic ice caps/sheets, releasing more water into the oceans and causing eustatic sea level rise.	
	16	**What undesirable coastal effects are likely to occur as a result of sea level rises?**	**1.**	Increased coastal erosion.
			2.	Coastal flooding.

	Question		Answer
Sea level rise	17	**What parts of the UK are likely to be subject to the greatest levels of relative sea level change in the coming decades? Why?**	South-eastern parts of the UK – these parts of the UK are currently subsiding, meaning that eustatic sea level change in this area will exacerbate global isostatic sea level change.
	18	**Suggest how rising sea level will affect people living in coastal areas.**	There are hundreds of millions of people living in coastal areas, some on flat, low-lying land. A number of large cities and other densely populated areas are built in coastal areas, including London. Homes, businesses and land will all be flooded unless significant coastal defences are constructed, causing a raft of social, economic and also environmental issues.
	19	**How can sea level rise alter the availability of freshwater resources?**	As sea level rises, the area where salty seawater and fresh river water mix moves upstream, making it impossible to extract fresh water from the lower courses of many rivers. In addition, salt water can intrude into fresh groundwater stores, which are often tapped as a water resource.
	20	**How does the insurance industry influence whether people choose to settle in areas of high flood risk?**	The insurance industry only offers home insurance to people in flood-prone regions upon the payment of a high insurance premium. Such high premiums are effective in reducing the number of people willing to move into areas of high flood risk.

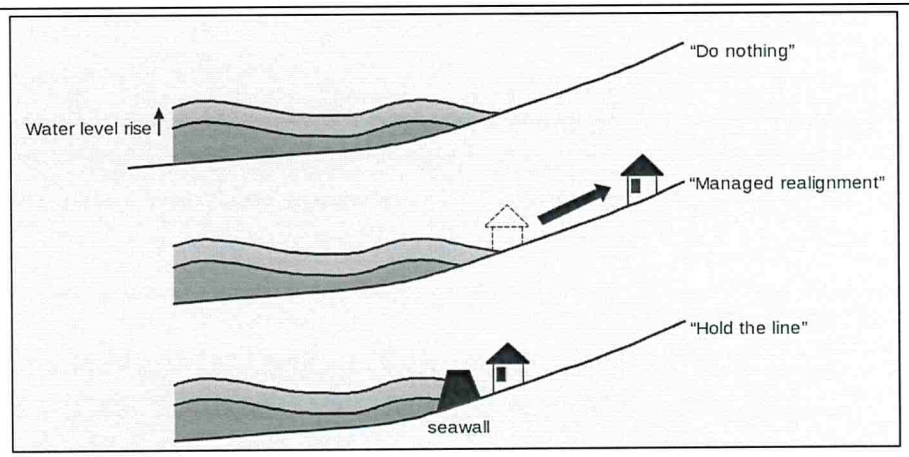
Learning Grid 6: Coastal Management

HOD: pp. 116–124
CAM: pp. 93–105
ZZ-RP: pp. 41–47

	Question		Answer	
Hard and soft coastal protection	1	**What are the two main aims of coastal protection schemes?**	**1.**	To defend against flooding.
			2.	To prevent, or limit, coastal erosion.
	2	**What is hard engineering?**	Hard engineering involves building structures with the specific purpose of disrupting natural processes, in order to defend an area against flooding or coastal erosion.	
	3	**What is soft engineering?**	Soft engineering involves manipulating natural materials and systems to provide defence against flooding or coastal erosion.	
	4	**Decide whether each method in the table opposite is a 'hard' or 'soft' engineering method.**		

Method	Hard or soft engineering?
Barrages	Hard
Revetments	Hard
Dune regeneration	Soft
Sea walls	Hard
Managed retreat	Soft
Do nothing	Soft
Groynes	Hard
Offshore reefs	Hard
Beach nourishment	Soft
Gabions	Hard
Rock armour	Hard
Cliff fixing	Hard

	Question		Answer	
Hard and soft coastal protection	5	**Answer the following questions regarding sea walls:** **a. How do sea walls protect the coast?** **b. Why are sea walls built in a recurved shape?** **c. Why do sea walls need to be fitted with drains?**	**a.**	Sea walls absorb wave energy.
			b.	This shape acts to throw waves backwards upon impact with the wall.
			c.	Drains are required so that any water that overtops the sea wall is able to drain away and not accumulate on the landward side of the sea wall.
	6	**What is the goal of rock armour, gabions and revetments?**	To absorb the force imparted by wave energy that would otherwise act to erode the coastline.	
	7	**How do groynes prevent beach erosion?**	Groynes disrupt longshore drift, as well as breaking up waves as they approach the beach.	
	8	**How are cliffs strengthened during cliff fixing?**	Iron bars are used to stabilise the cliff.	
	9	**How do offshore reefs protect cliffs located behind them?**	Offshore reefs force waves to break further out to sea, so that a wave has less energy when it meets the cliff face.	
	10	**What is a barrage?**	A barrage is a dam created across an estuary with the goal of stopping seawater incursions from moving inland along the course of the river.	
	11	**What are the disadvantages of hard-engineering schemes?**	Hard-engineering schemes are expensive and need regular updating; may cause unintended problems in other nearby regions; can spoil the natural landscape.	
	12	**What is beach nourishment / beach feeding?**	This involves moving beach material (i.e. sand and/or shingle) from one location to another, in order to replace material lost to longshore drift.	
	13	**Briefly outline the kind of processes involved in dune nourishment.**	Dune nourishment involves planting additional vegetation on sand dunes and restricting activities that lead to vegetation loss (for example, tourism and agriculture).	

		Question	Answer
Hard and soft coastal protection	14	**What is managed retreat?**	This involves abandoning sea defences and allowing certain low-lying areas to be flooded. The land may subsequently be developed using soft-engineering principles in order to reduce the energy of waves.
	15	**What are the main advantages of soft-engineering schemes?**	These schemes are generally lower in cost relative to hard-engineering schemes and, as they use natural materials and processes, they tend to lead to a more natural-looking solution.
	16	**What economic justifications can be given for doing nothing to stop coastal erosion?**	When the cost of protecting the coast from natural erosional processes is more than the cost of allowing those processes to continue (and, instead, compensating affected parties).
Coastal management policies	17	**Explain how each of the policies shown in the diagram is a form of coastal management.**	 Each of the policies determines how and where coastal defences will be managed. For example, they determine whether land will be protected, or lost to the sea. Each land use will be used as a factor – for example, towns, cities and important installations will be protected behind defences, while low-value land may be lost because of the high cost of the defences.
	18	**How can the concept of 'sustainable development' be applied to coastal management?**	Processes within sediment cells are interlinked. For example, adding groynes to one stretch of coastline can negatively affect the coastline due to increased erosion further down the coast. Therefore, coastal management should be 'holistic', taking the whole coast into account, the social, economic and environmental factors. The use of soft engineering can also provide valuable habitats.

	Question		Answer
Coastal management policies	19	**What is the name of the series of coastal management systems in England and Wales (there are 22)?**	Shoreline management plans (SMPs).
	20	**What period is the longest time considered for the system?**	100 years.
	21	**What is the purpose of the management?**	To implement sustainable policies over three timescales to facilitate management which considers both people and the environment.
	22	**What is ICZM an abbreviation of?**	Integrated coastal zone management.
	23	**When was ICZM developed?**	In 1992 (at the UN Rio de Janeiro Earth Summit).
	24	**What is the purpose of ICZM?**	There are many different economic activities which take place in coastal zones, which can cause damage to the natural environment. However, each use may have different policies. The idea of ICZM is to pull together each policy, and to ensure that they are sustainable, and include habitats and ecosystems. ICZM also covers large areas because policies in different areas and between different sectors can conflict.
	25	**How does the management cycle of ICZM work? Fill in the gaps.**