THE DUSTON SCHOOL 11-19

Knowledge Organiser World Studies

KS4 Geography
Topic 1a – Coastal Landscapes

Name:

Class Teacher:

Enquiry Question:

How does geology affect the UK Landscape?

Big Questions that will help you to answer this enquiry question:

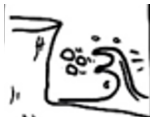
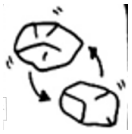
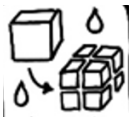
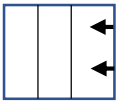
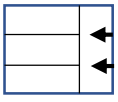
1. What are the characteristics of the UK's main geology and landscapes?
2. What role does geology play in forming distinctive landscapes in the UK?
3. What role do human activities play in forming distinctive lowland landscapes in the UK?
4. What are the different types of erosion, weathering, mass movement and transport processes that happen along coastlines.
5. How does the geological structure, rock types and wave action shape coastal landscapes?
6. How are the key coastal erosional landforms formed?
7. How are the key coastal depositional landforms formed?
8. How do human activities cause changes in coastal landscapes and how do these changes affect people and the environment?
9. What are the different types of coastal management techniques and how can these lead to a change in coastal landscapes?
10. How have landforms along the Dawlish Coast been created?

Homework

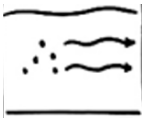
Big Question	Task	Due Date
2	Revise pages 6-7	
4	Revise page 8-10	
6	Revise pages 11-12	
8	Revise pages 13-15	
10	Revision for end of topic test	

Key terms found in the glossary on pages 4 – 5 will be tested throughout the unit

GLOSSARY

Key term	Icon	Definition
Abrasion		The effect of rocks being flung at the cliff by powerful waves and rubbing the cliffs away.
Attrition		The knocking together of pebbles, making them gradually smaller and smoother.
Biological weathering		Break down of rocks in situ by plants and animals burrowing into and weakening the rock.
Chemical Weathering		Break down of rocks in situ by changes in rock mineral composition, often by rain and water.
Concordant		Rocks that lie parallel to the coast.
Discordant		Rocks that lie perpendicular to the coast, often resulting in headlands and bays.
Erosion		Wearing away and transport of materials
Fetch		The distance of open water over which the wind blows
Hard engineering		Building artificial structures such as sea walls aimed at controlling natural processes.
Hydraulic action		The sheer power of the waves forcing into cracks, compressing air and breaking the rocks apart
Mass movement		Movement of large amounts weakened rock / soil down a slope.

Glossary

Key term	Icon	Definition
Mechanical weathering		Break down of rock in situ by physical processes caused by changes in temperature (freeze thaw, exfoliation (heat expansion)).
Saltation		A hopping movement of pebbles along the seabed.
Slumping		Saturated soils and weak rock flow down the slope, often where there is permeable rock on top of impermeable rock.
Soft engineering		A sustainable approach to managing the coast which out using artificial structures
Solution		The dissolving of rocks such as limestone and chalk.
Suspension		Lighter particles carried (suspended) within the water.
Sustainable coastal management		An integrated coastal management plan for a stretch of coastline in England and Wales.
Traction		Heavy particles rolled along the seabed.
Wavelength		The distance between one crest of a wave and the next one.

BQ1. What are the characteristics of the UK's main geology and landscape?

Interlocking crystals

Formed by **volcanic activity**

Found in Scotland and N. Ireland. Anomaly found in Cornwall and Devon

Examples: Granite / Basalt

Formed in layers/bands of crystals

Changed due **to heat or pressure**

Found in Scotland and N. Ireland. Anomaly in Holyhead in Wales

Examples: Slate / Marble

Sediments compact to create rock

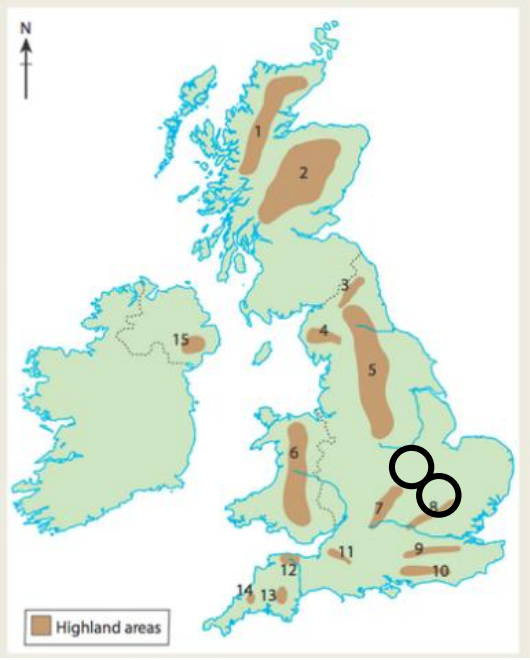
Rounded grains in layers

Formed in water bodies by **Lithification**

Most widely found rock in the UK. Anomaly found around John O'Groats.

Examples: Sandstone / Limestone

BQ2. What role does geology play in forming distinctive landscapes in the UK?

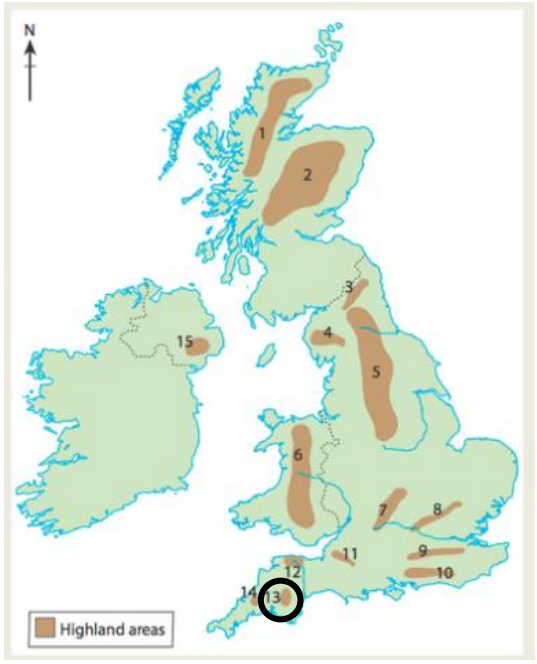


290 million years ago a dome of magma developed underground

Cooled and contracted forming granite with joints

Joints vulnerable to freeze-thaw weathering and mass movement i.e. slumping

Large blocks remain standing – **Tors**



Formation of lowlands i.e. North & South Downs

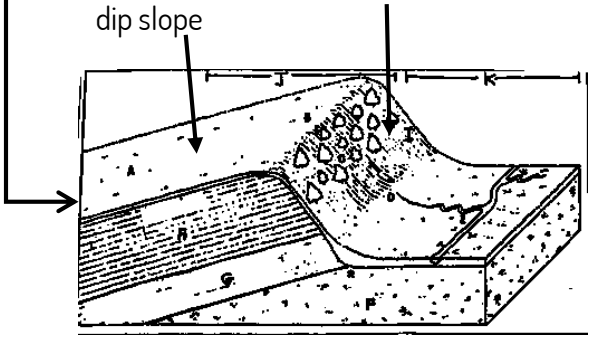
75 million years ago, Britain covered in warm, tropical seas.

Marine deposits created chalk in the North and South Downs.

30 million years ago, compacted layers of sediment were forced upwards = dome.

Water eroded the softer rocks at the centre of the dome leaving two **escarpments.**

South Downs: Steep scarp slope and gentle dip slope



BQ3. What role do human activities play in forming distinctive lowland landscapes?

South Downs National Park

Agriculture

Chalk grassland used for sheep grazing as grass is rich in nutrients

Decline in chalk grassland due to use of chemicals in farming.

Decline in traditional practices i.e. sheep grazing, has led to **scrub encroachment** on the remaining grassland.

Forestry

Deciduous woodland removed –moorland, settlements and farmland

Replaced by coniferous woodland, threatening some of the ancient trees e.g. wildwood

Settlement

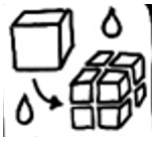
S 'Spring line settlements' built on south slopes for natural shelter.

Many settlements have had new developments not in keeping with local character i.e. design/materials.

BQ4. What are the physical processes working at the coast?

Weathering is the process of the weakening and breakdown of rocks 'in-situ'

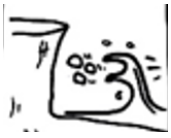
Mechanical – Repeated freezing and thawing of water in a crack. When the water freezes it expands by 10% putting stress on the rock. Repeated cycles, cause the crack to widen and rocks to break off.



Chemical – rainwater is slightly acidic, so when it falls on limestone and chalk a weak chemical reaction occurs causing the rock to break down.

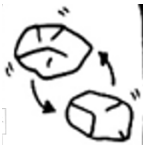
Biological – roots of plants widen cracks in rocks. Burrowing animals cause the rock to weaken/collapse.

Erosion is the wearing away and transport of materials



Abrasion - Pebbles scrape and rub against the cliff when the waves hurl them at it. It removes small pieces of rock on each impact.

Hydraulic Action - Powerful destructive waves compress air before them and force it into cracks. This compression can force the rock apart and break it up.



Attrition - Eroded particles smash against each other in the water breaking up into smaller pieces. Their edges become more rounded forming pebbles.

Solution - Acids contained in sea will dissolve some types of rock such as chalk or limestone.

BQ4. What are the physical processes working at the coast?

Mass Movement is movements of soil and rock debris down slopes in response to the pull of gravity

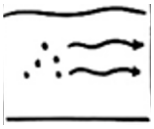
Sliding – downhill movement of large amounts of rock, soil or mud. Occur on steep cliffs previously weakened by weathering.

Slumping – Often occurs after long periods of rainfall. The rain seeps through permeable rocks, when this meets an impermeable rock, the saturated soil and weaker rock slumps in a rotational manner along a curved surface.

Transport is the movement of material in the sea and along the coast by waves

Traction – large sediment roll along the sea bed

Saltation – small pieces of shingle or large grains of sand are bounced along the sea bed



Suspension – Lighter particles carried (suspended) within the water.

Solution – Some minerals dissolve in sea water and are carried in the sea water. Particularly limestone or chalk cliffs.

Deposition takes place where the flow of water slows down.

Waves lose energy in sheltered bays

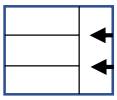
Where water is protected by **spits** or **bars** it becomes calm and sediment is deposited.

Constructive waves build beaches by depositing sand high up the beach

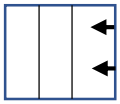
BQ5. What factors shape coastal landscapes?

1. Geology

Rock types such as chalk are more resistant to erosion than rocks such as glacial till and clay



Discordant coastlines – bands of resistant and less resistant rocks run at **right angles** to the coastline



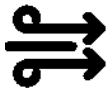
Concordant coastlines – bands of resistant and less resistant rocks run **parallel** to the coastline

2. Weather and Climate

Seasonality (pattern of change in the UK's weather between spring, summer, autumn and winter) In the winter – freeze-thaw weathering on cliff faces due to differences between day and night temperatures

Climate – temperate climate, meaning winters are mild and wet and summers are warm and wet.

Storm waves are common autumn and winter and cause higher erosion rates



Prevailing winds in the UK are from the southwest. Coastlines in Devon experience a long fetch as the winds travel over the Atlantic Ocean.

3. Wave type

Characteristic	Constructive Wave	Destructive Wave
Wave height	Lower	Higher
Wave frequency	6-8 a minute	13-15 a minute
Swash	Stronger	Weaker
Backwash	Weaker	Stronger
Impact on the beach	Build beaches	Destroy beaches

The power of the wave is determined by:

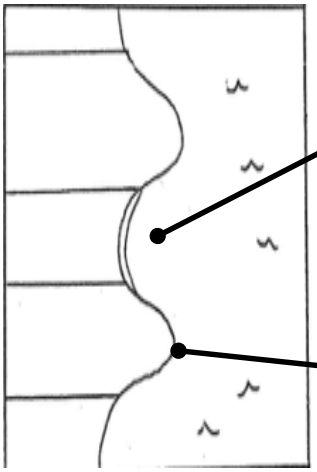
How long the wind has been blowing (**wind duration**)

How strong the wind is (**wind speed**)

The length of the **fetch** – this is the distance of open water over which the wind blows

BQ6. How are the key coastal erosional landforms formed?

Headlands and bays



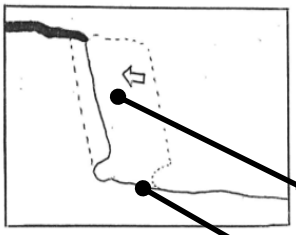
Different rock types erode at different rates.

Weaker bands of rock such as clay will erode more quickly to form **bays**.

The bays are **sheltered** and so **deposition** occurs leading to **beaches** forming.

The **more resistant bands** are eroded much more slowly. They stick out into the sea to form **headlands.**

Wave cut platforms



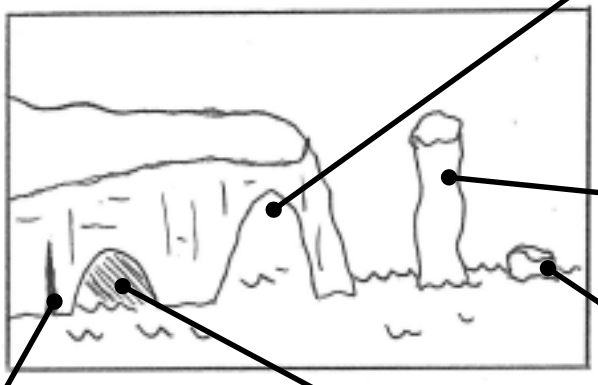
At high tide waves break against the base of the cliff and eroding to form a **wave cut notch** by hydraulic action and abrasion.

The notch will get larger and **undercut** the cliff.

Overlying rock will **collapse due to gravity** and the **cliff will retreat.**

The cliff will **retreat** leaving a gently sloping rocky platform called a **wave-cut platform.**

Caves, arches, stacks and stumps



Abrasion and undercutting will widen the cave and eventually it will meet the cave on the other side of the headland to form an **arch.**

Eventually the arch is undercut by erosion processes and weakened by weathering making it **collapse** due to gravity. This leaves an isolated **stack.**

The stack will eventually collapse to from a **stump.**

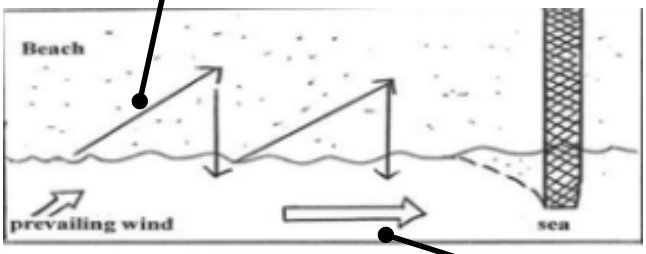
A line of weakness, fault or **crack** in the rock makes the cliff vulnerable to **hydraulic action.**

The hydraulic action forces the crack apart to eventually form a **cave.**

BQ7. How are the key depositional landforms formed?

Longshore Drift

The swash carries the material up the beach at an angle because of the **prevailing wind.**



The backwash carries the material straight back down the beach because of **gravity.**

Material is carried along the shore

Beaches

Beaches start to form where deposition exceeds erosion and constructive waves dominate.

Sediment has 4 main sources; from rivers, cliff erosion, constructive waves or via longshore drift.

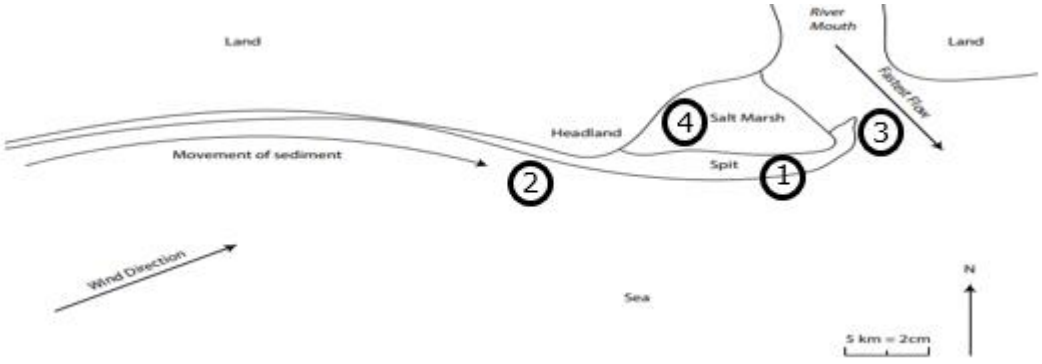
As a result sediment is deposited in this low energy environment with a stronger swash than backwash.

Beaches tend to build up in sheltered bays where material such as sand and shingle can accumulate.

Larger material is often deposited higher up the beach during storm events to form a storm beach or berm.

BQ7. How are the key depositional landforms formed?

Spits



1. A **spit** is a long narrow finger of sand or shingle jutting out into the sea.

2. It is formed by long-shore drift continuing when the coast suddenly changes direction and sand is deposited out to sea.

3. This builds up over time and the end becomes curved due to strong winds and tidal currents.

4. Saltmarshes and sand dunes form in the sheltered area behind the spit

BQ8. How does coastal recession and flooding impact people and the environment?

Coastal recession is the process in which weathering and erosion causes cliffs to recede (move backwards) inland.

Impact on people

1100 miles of coastline in the UK is classed as being at risk from erosion.

Potential loss of homes

Loss of farmland for farmers

Disruption to communication networks – road and railway lines – creating problems for commuters

Decreasing value of homes and difficulties in obtaining home insurance.

Coastal flooding

Around 2.1 million properties are at risk from flooding in the UK, with 50% at risk from the sea.

Loss of life from drowning

Contamination of fresh water supplies with salt water

Disruption to gas and electricity supplies.

BQ9. Coastal Management: Hard

Hard engineering – The use of concrete and artificial structures by engineers to defend the land against erosion.

- o Timber or rock structures built on the beach at right angles to the coastline.
- o Cost £150,000 each.
- ✓ Trap sediment by interrupting longshore drift and the beach formed protects the coast from destructive waves
- × They interrupt longshore drift and so can cause problems elsewhere.
- × They can look unnatural.

- o Large boulders piled up in front of the cliffs to protect them from the force of the waves.
- o They absorb the wave energy.
- o Cost £200,000 per 100 metres.
- ✓ Cheaper than other methods and easier to maintain.
- ✓ Can be built quite quickly if rocks dumped by barge at high tide and moved into place.
- × Can be expensive to transport.
- × May not fit into local geology and can look ugly.
- × Limits access to the beach.

- o A concrete or rock barrier against the sea. Placed at the foot of cliffs or as part of a promenade.
- o Costs £5000 - £10,000 per metre.
- ✓ Effective at stopping waves
- ✓ Can be incorporated into a promenade for a smart looking sea front.
- × Very expensive so only used on resort seafronts.
- × Lasts 25 years so will need to be replaced.

- o Wire cages that are filled with rocks.
- o Usually placed at the base of cliffs to protect them from waves.
- o Cost up to £50,000 per 100 metres.
- ✓ Cheap to produce
- ✓ Will become vegetated and merge in to the landscape eventually.
- × Looks unattractive at first.
- × Cages only last up to 10 years before rusting.

BQ10. Coastal Management: Soft

Soft engineering - Managing erosion by working with natural processes. Working with nature not fighting it.

- Sand and shingle is dredged from offshore and transported by barge to the coast.
- The beach is re-profiled to be higher and wider.
- Costs up to **£500,000 per 100 metres.**
- ✓ Relatively cheap and easy to maintain.
- ✓ Increased tourism
- ✓ Works well with groyne construction to 'fix' the beach.
- × Needs constant maintenance and one storm can remove the beach.
- × Work can only be done in winter months to avoid loss of tourist revenue.
- × Moving sediment may cause problems elsewhere.

- Marram grass is planted to stabilise dunes and stop the sand being blown away.
- The dunes then protect the coast.
- **Cost £400 to £2000 per 100 metres.**
- ✓ Looks natural and provides a habitat for wildlife including sand lizards.
- ✓ Relatively cheap
- × Time-consuming to plant – often use volunteers to keep costs down.
- × Restricting access can be unpopular.

- Allowing cliff erosion to occur as nature taking its course.
- This can create natural habitats such as marsh which then protects from further erosion.
- **Cost: Medway scheme cost £28 million in total.**
- ✓ Less money is spent as defences are not replaced.
- ✓ It is sustainable at a time of rising sea levels.
- ✓ Natural environments are created.
- × Some people may have to move as their homes are flooded by the advancing sea.
- × Can be unpopular with coastal habitats as they feel abandoned by the government.
- × Not possible on densely populated coastlines.

BQ 11. Named Case Study: Dawlish Warren

Human factors changing the spit

Housing developments in 1930s on the spit, these houses were washed away by the end of 1940s.

Sea defences

Granite boulders used as rip rap to protect the railway line in **1917**

1940s railway sleeper barriers installed and trees planted to stabilise the dunes = unsuccessful

1970s: 300m concrete sea wall next to the existing rock armour revetment

18 groynes to stabilise beach levels.

Physical factors changing the spit

Erosion in the 1930s caused the 2 spits to join creating a single spit.

High spring tides and strong winds **(storm surges)** have driven waves across the southern and eastern parts

Erosion of the beach and dunes have caused the spit to retreat e.g. 2013-14 storms caused 5 metres of sand to be lost from the southern dunes.

Why is it an important resource?

Designated a Local Nature Reserve in 1978 and a National Nature Reserve in 2000 – habitat for coastal species e.g. wading birds

Fishing industry – historically and culturally important, providing fresh seafood. Mussels and oysters are common.

Tourism – attracts 480,000 visitors each year, 13% of local employment is via tourism.

Homes – a few houses and a small number of businesses are located on the spit.

Recreation – water-based activities and golf etc.

Sample Assessment Material

1 UK landscapes are made up of different rock types.

(a) (i) Identify **one** example of a metamorphic rock.

(1)

- ☐ **A** sandstone
- ☐ **B** granite
- ☐ **C** slate
- ☐ **D** basalt

(ii) State **one** characteristic of a metamorphic rock.

(1)

2 Coastal landscapes are constantly being changed by different processes.

(a) Study Figure 1 in the Resource Booklet.

(i) Identify depositional landform **X**.

(1)

(ii) Name **one** type of erosion that might have an impact on this landscape.

(1)

(iii) Flooding affects people and the environment in coastal landscapes.

Explain how **one** human activity increases the chance of coastal flooding.

(2)

Figure 1

A coastal landscape in Morar, North-west Scotland

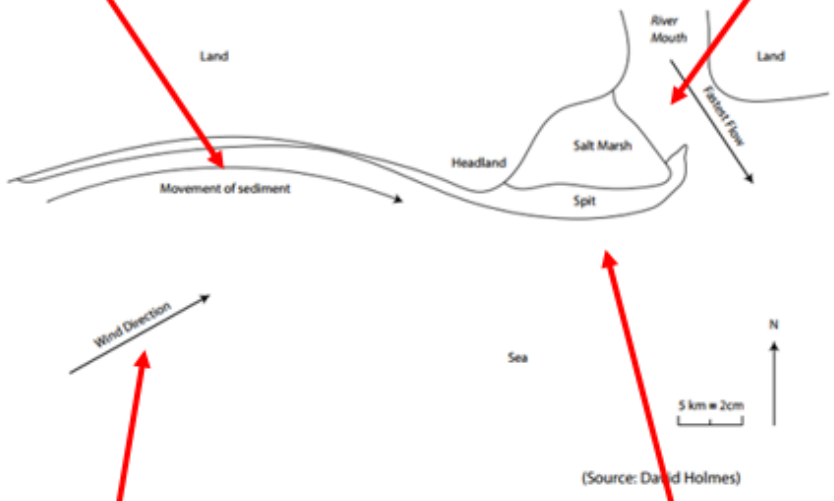
Sample Model answers

THE EXAMINE QUESTION (TEACHER MODEL)

In the examine question you will be expected to interpret a resource to support your answer. Look at the example below of a spit, it's important to use the image to support your response therefore, you should decide on the information that you want to include in your answer from the resource.

Longshore drift transport the sediment from west to east.

Sediment will be transported by the river, which will then be trapped behind the spit, forming a salt marsh.



(Source: David Holmes)

Figure 2

A diagram showing the formation of a spit

The prevailing wind comes from a South-Westerly direction.

The spit stretches 12km from the end of the original coastline.

The best answers will have an accurate formation sequence and have a clear organised structure.

The best answers will make reference to the Figure through the answer.

Sample Model answers

The formation of the spit in Figure 1 will begin with the **south-westerly prevailing wind** causing the **waves swash to push sediment up the beach at an angle. The backwash will then bring material back down the beach at right angles to the coast, under the force of gravity. The swash and backwash process will result in a zig zag movement of material along the coastline, known as longshore drift.** As shown in Figure 1 the direction of longshore drift is transporting sediment from **west to east.**

When there is a change in the direction of the coastline, **usually because of an estuary, the transported material is deposited offshore.** Overtime the build-up of material off the coast will cause a spit to form, stretching across from the headland in an easterly direction. The estuary will limit the growth of the spit due to the deep waters and currents. As the spit grows sheltered waters develop behind the spit, causing finer sediments to settle and begin to fill in the area, eventually leading to the development of a saltmarsh. The spit becomes curves towards the north of the estuary due to the river currents and secondary wind direction.

Clear evidence of using the information from the Figure to support the points made.

Points are developed with reference to specific physical processes.

Examiners Tip

"The best answers will have an accurate formation sequence and have a clear organised structure."