

# Coastal landscapes in the UK.

## Key topic ideas

### Physical processes

Wave types

Coastal processes

Weathering

Mass movement

Erosion

Transportation

Deposition

### Landforms

Structures and rock types

Erosion based landforms

Headlands

Bays

Cliffs

Wave cut platforms

Caves

Arches

Stacks

Deposition based landforms

Beaches

Sand dunes

Spits

Bars

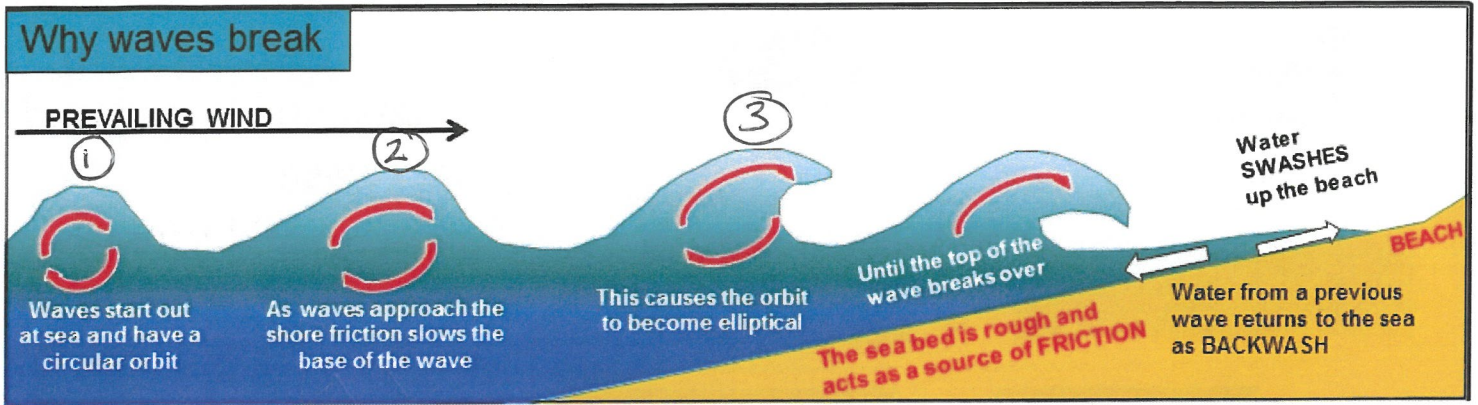
## The coastal system

The shore line acts as a giant conveyor belt: rocks are broken down and worn away in some places. The resulting sediment is transported by waves and wind and deposited in other places.



**Activate** – Write your answers to the questions in the correct box

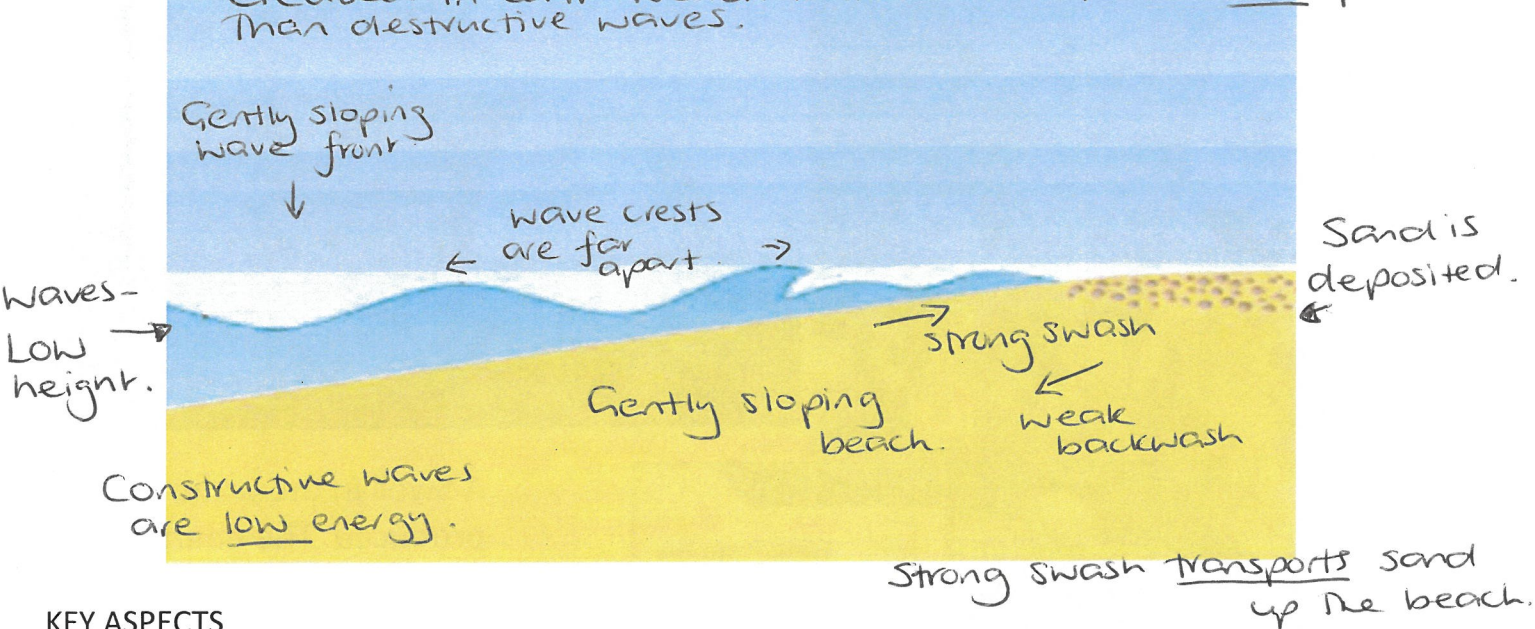

*Green pen your answers*



- 1 In open water there is very little horizontal movement of water. The sea bed interrupts this circular movement
- 2 The water becomes shallower and the circular orbit of the water particles changes to an elliptical shape.
- 3 The top of the wave begins to move faster causing water to back up from behind and rise to a point where it starts to topple over (Break)

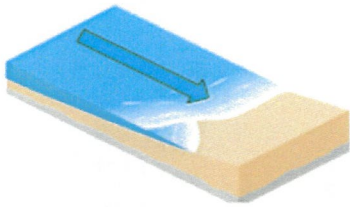
### Constructive Waves (spilling waves)

Created in calm weather and have much less power than destructive waves.

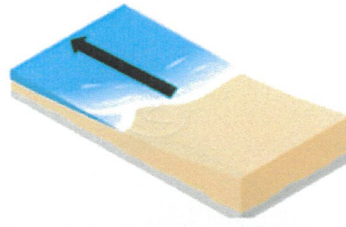


#### KEY ASPECTS

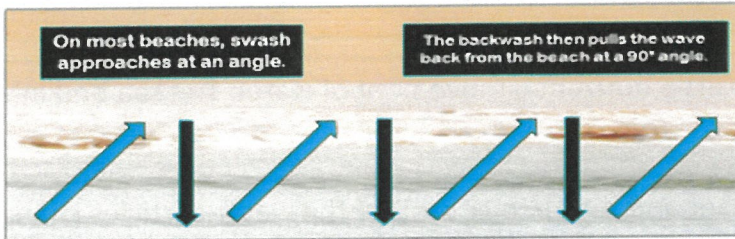
- Low waves that surge up the beach and spill with a powerful swash
- They carry large amounts of sand and pebbles and construct or extend a beach
- These waves are often formed by storms which occurred hundreds of miles away.



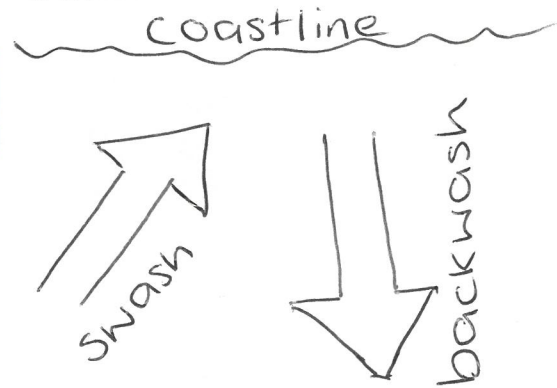
When a wave breaks, water rushes up the beach. This is called the swash.



The water then runs back down the beach, back out to the sea under the force of gravity. This is called the backwash.

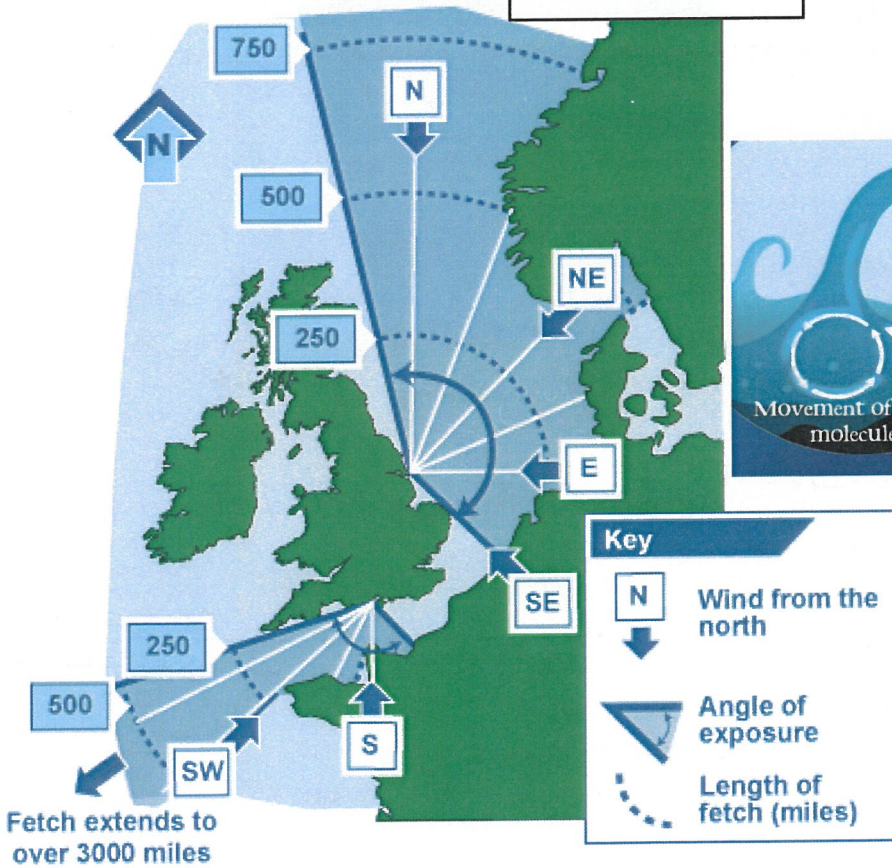


Sketch own diagram to describe swash and backwash

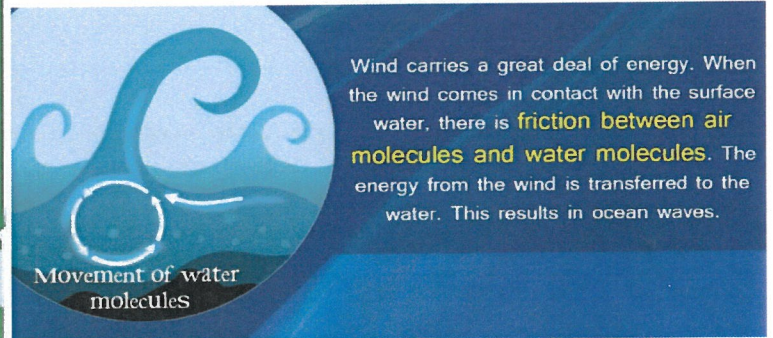


## The fetch

The distance the wind blows across the water



## Wave formation



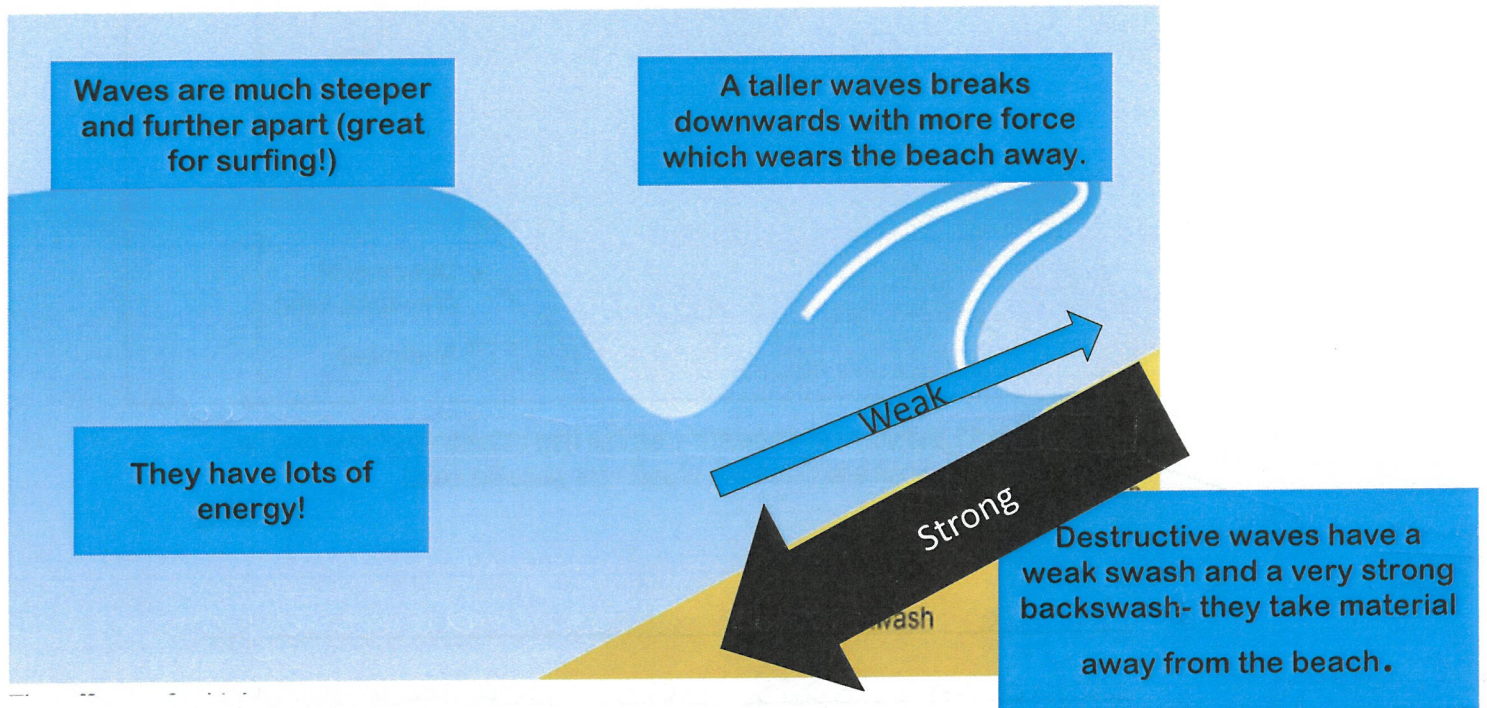
Wind carries a great deal of energy. When the wind comes in contact with the surface water, there is friction between air molecules and water molecules. The energy from the wind is transferred to the water. This results in ocean waves.

A Swell in the water is produced. The energy of the wind causes water particles to rotate inside the swell and this moves the wave forward.

## Destructive waves (plunging waves)

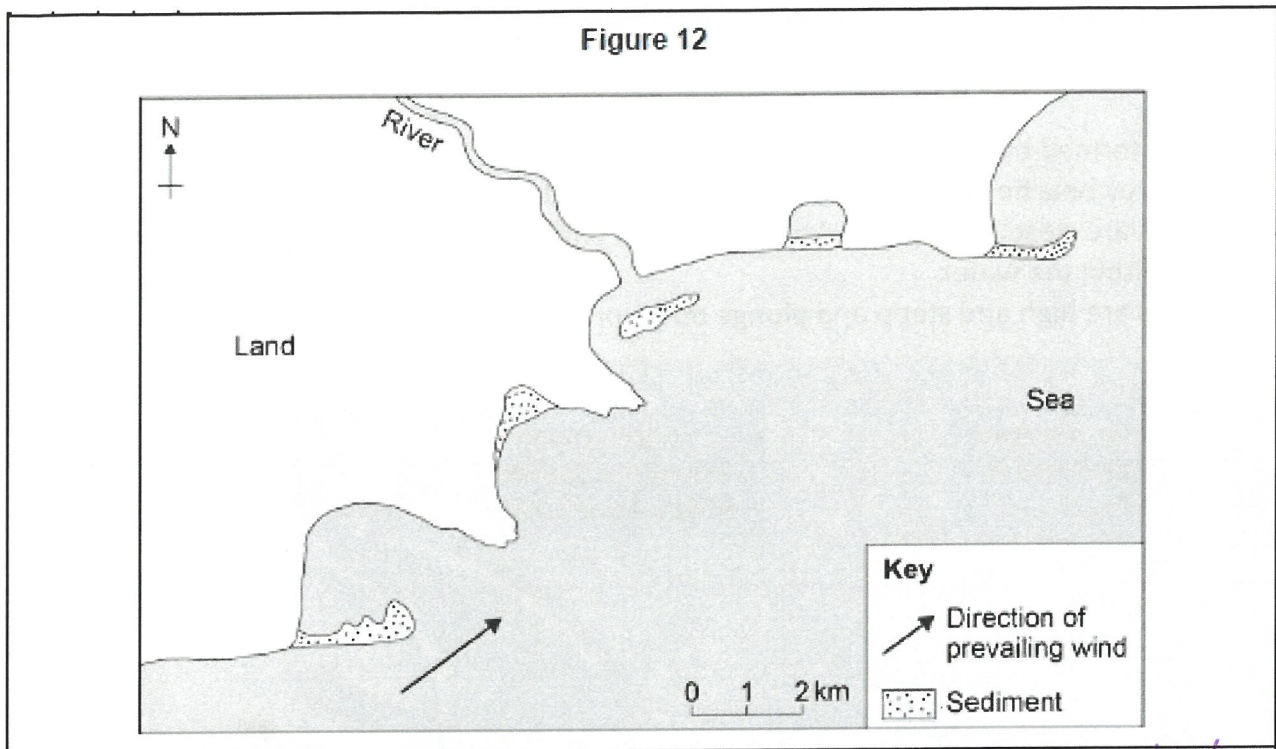
### KEY ASPECTS

- These are formed by local storms close to the coast.
- They destroy beaches by pulling sand and pebbles out to sea
- The waves are closely spaced and often interfere with each other causing chaotic swirling within the water.
- The waves are high and steep and plunge down onto the shoreline



Wave characteristic	Constructive	Destructive
Wave height	Low	High
Wave length	Crests far apart.	Waves are further apart.
Type of wave (Spilling or Plunging)	Spilling	Plunging
Strength of swash	Strong	Weak
Strength of backwash	Weak	Strong
Net beach sediment (gain or loss)	Gain	Loss

Study Figure 12, a sketch map showing features of coastal deposition.



0 3 . 7 Using Figure 12 and your own knowledge, explain how different landforms may be created by the transport and deposition of sediment along the coast. *reasons needed.* [6 marks]

*Must refer to Fig. 12.*

- Geology
- Fetch

Figure 12 shows depositional landforms including: spits, bars, beaches and potentially marshland.

Due to the direction of the prevailing wind reaching the coastline at an angle long shore drift would be a means of eroded material being transported. The shape of the coastline therefore aids the creation of spits - when the wave energy reduces - it deposits sediment. This continues over time. To the



North of the sketch map there are two headlands close to each other. The deposited material here builds from a spit to a bar, closing off the bay. Behind this bar the sediment will start to encourage salt marsh vegetation and develop a thriving salt marsh or mud flat with additional material that has been transported and deposited by the river.

### GCSE GEOGRAPHY FEEDBACK

WWW:

EBI:

**Activate** – Write your answers to the questions in the correct box


*Green pen your answers*



Describe how this arch formation was formed



This arch was formed through erosional processes such as hydraulic action, abrasion and attrition. This has taken millions of years to form and only forms at a headland with geology that has faults/cracks. There also needs to be strong wave energy.

## Weathering and mass movement

### Terminology

Weathering – the weakening or decay of rocks in their original place on or close to the ground surface.

### Three types of weathering

1. **Mechanical (physical weathering)** – The disintegration (break up) of rocks usually associated with extremes of temperature
2. **Chemical weathering** – Caused by chemical reactions when rain water hits rock and decomposes or eats it away.
3. **Biological weathering** – Flora (plants) grow roots into the cracks in the ground and Fauna (animals) burrow into weak rocks breaking up the rocks. Both results in a natural breakdown of the rocks.

## Mechanical weathering

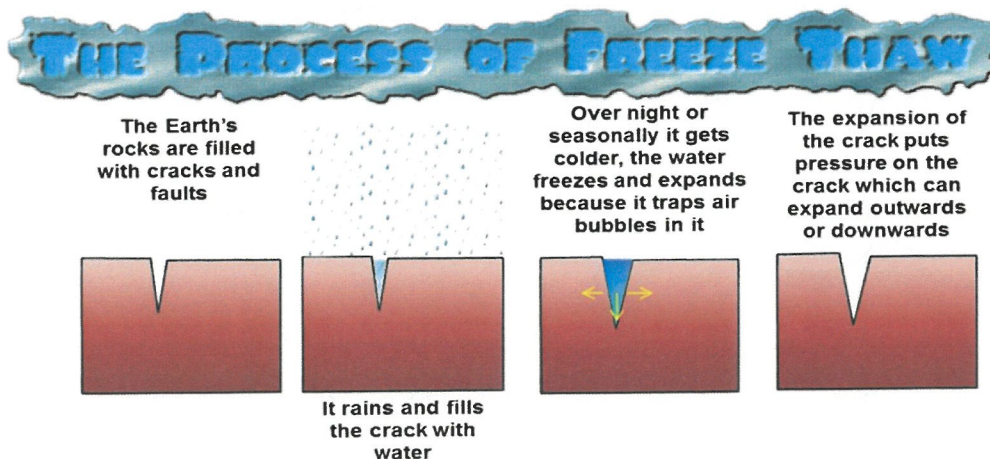
### Freeze-thaw weathering (Frost Shattering)

Water from rainfall becomes trapped in a crack or joint in the rock (1).

If the air temperature drops below freezing, the water will freeze and expand, putting pressure on the rock (2).

The ice will melt when the temperature rises above freezing.

If this process happens repeatedly, the rock will weaken and eventually break up (3).



## Saltwater weathering

- Seawater contains salt. When the water evaporates it leaves behind salt crystals in cracks and holes.
- These crystals grow and expands putting pressure on the rock and bits will eventually break off.



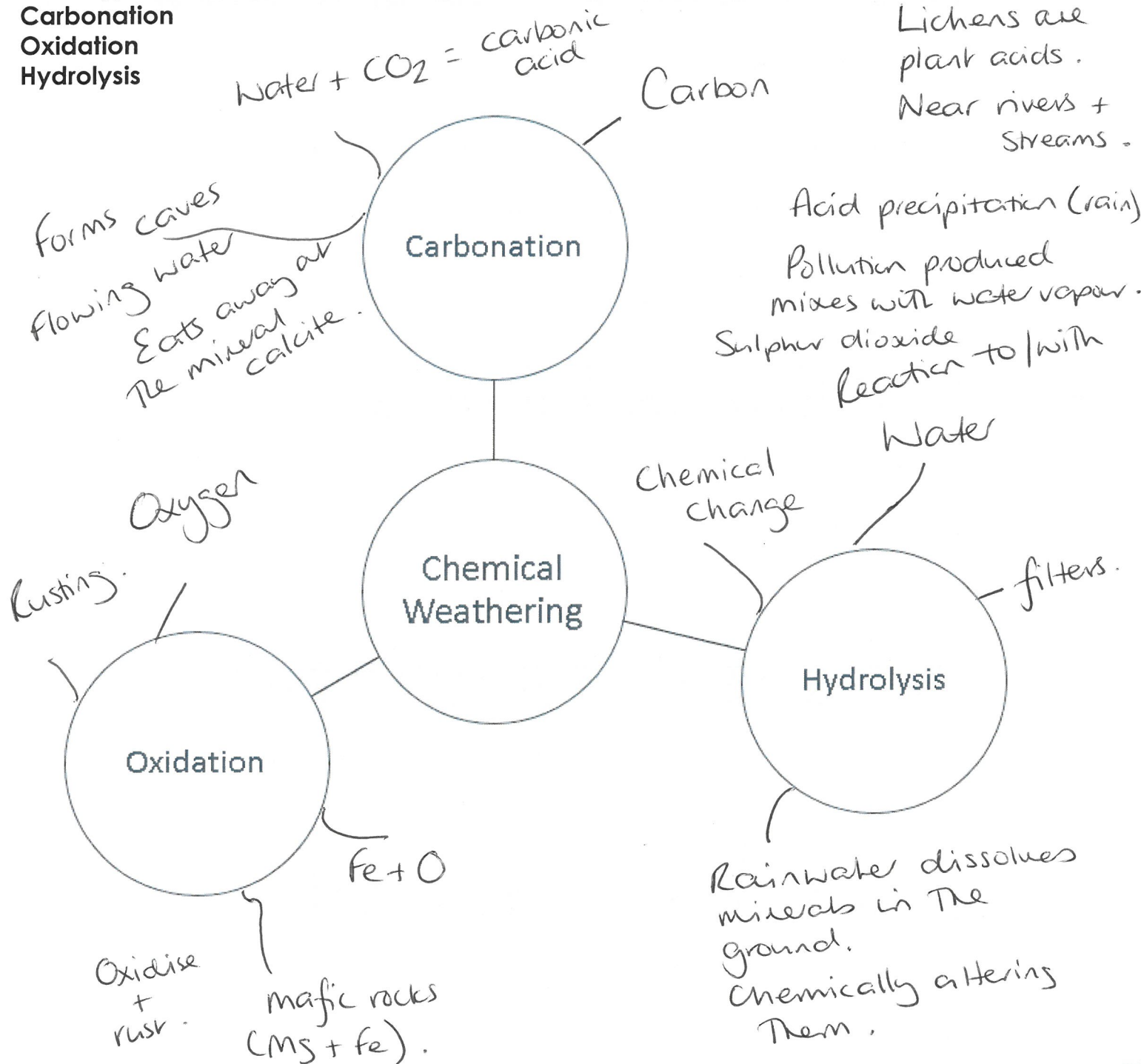
## Chemical weathering

### Three types of chemical weathering-

Carbonation

Oxidation

Hydrolysis



## Oxidation

The reaction of rock minerals with oxygen, eg iron, to form a rusty red powder leaving rocks more valuable to weathering

## Hydrolysis

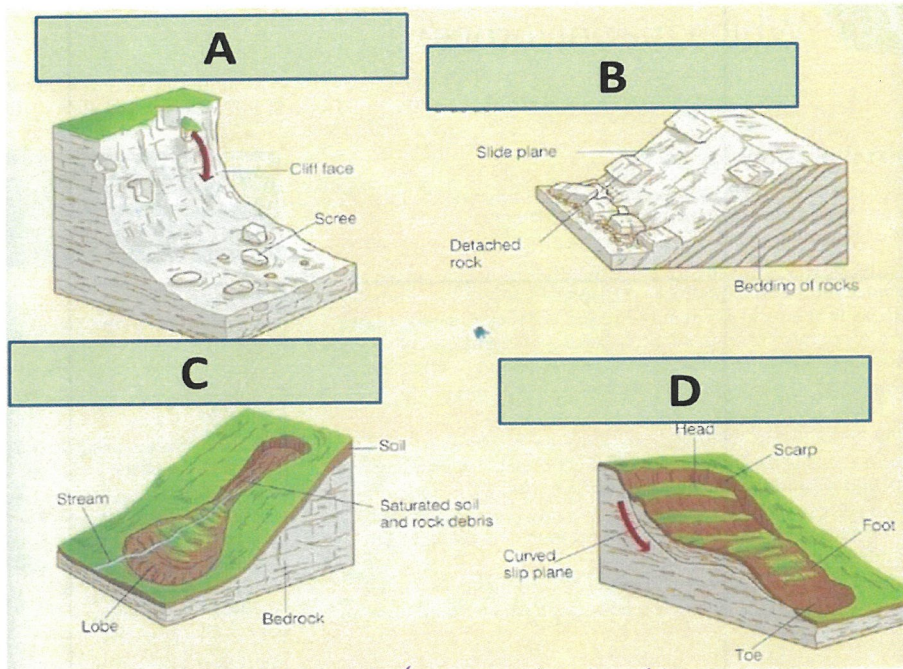
Where mildly acidic water reacts with minerals in the rock to create clays and dissolvable salts both degrading the rock and forming weaker materials which will lead to further degradation

## Carbonation:

When rainwater absorbs  $\text{CO}_2$  from the air it becomes slightly acidic (carbonic acid). When this acidic rain comes into contact with alkaline rocks such as chalk and limestone it produces a chemical reaction causing the rocks to slowly dissolve.

## Mass Movement

Mass movement is the downslope movement of rock, soil or mud under the influence of gravity. Heavy rainfall is usually the trigger, but the scale of movement is determined by the extent of weathering on the slope. Both mass movement and weathering provide an input of material to the coastal system. Most of this material is carried away by waves.



### Types of mass movement

A= Rockfall – Fragments of rock breakaway – often due to freeze thawing

B= Landslide- Blocks of rock slide downhill

C = Mudflow – Saturated soil and weak rock flows down a slope.

D= Rotational slip - Slump of saturated soil and weak rock along a curved surface

→ appearance / what it is like

Describe the effects of weathering and mass movement on a cliffed coastline

(4 Marks)

Weathering happens in three ways, biological, chemical and mechanical - This is the degradation of geology in situ. Combining this with mass movement such as landslides where this broken material combined with the weight of precipitation and gravity moves large quantities of material which can move structures, damage roads and even change the shape of a coastline due to material transporting and participating in erosion.

**Activate** – Write your answers to the questions in the correct box


*Green pen your answers*

Question 3 Coastal landscapes in the UK

0 3 . 1 The following paragraph describes how coastal processes are linked.

Complete the paragraph. Choose the correct words from the list below.

deposition ✓ transported ✓ weathering ✓

[2 marks]

Erosion and weathering break down rocks in coastal areas.

Sediment is transported by the action of waves

and tides. Once the waves and tides have lost energy deposition

takes place.

## Coastal erosion

### Hydraulic power

The sheer force of waves breaking against the cliff will cause parts of the cliff to break away. As a wave hits the cliff face air is compressed in cracks in the rocks, blasting away small fragments of material. During storms hydraulic power can remove enough rock at the base of a cliff to make the cliff face unstable, resulting in rock fall

### Abrasion

The most powerful type of erosion affecting coastal areas in the UK. During storm conditions waves pick up sand and pebbles. When the waves break the sediment that they have been carrying is hurled at the cliff face, causing a sandblasting effect.

### Attrition

The constant moving of grains and pebbles wears away beach material, making them increasingly smaller and more rounded.

### Solution

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

Design a diagram which shows the coastal erosion processes

Hydraulic action  
force of water  
(power).



Abrasion

hurting rocks  
at cliff face



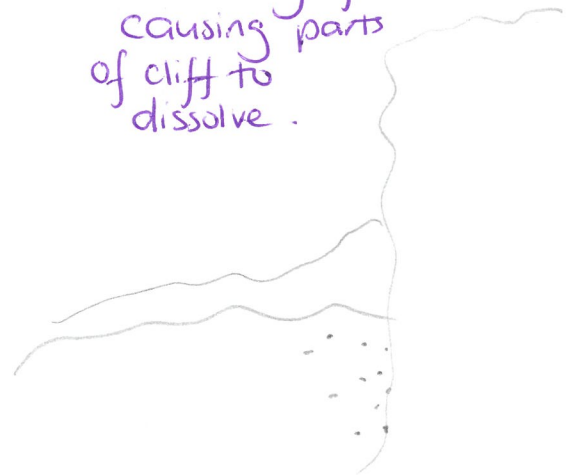
Attrition

Rocks colliding,  
reducing in size  
and smoothing.



Solution.

Acidity of sea water  
causing parts  
of cliff to  
dissolve.



The rate of cliff erosion will be higher where: (choose the three correct answers)

- a. The coast line is exposed to a large fetch
- b. Constructive waves are found
- c. Areas have large sandy beaches
- d. Strong winds create destructive waves
- e. Soft cliff rocks
- f. Hard cliff rocks

## Coastal erosion landforms

A **landform** is a feature of the landscape that has been formed or sculpted by the process of –

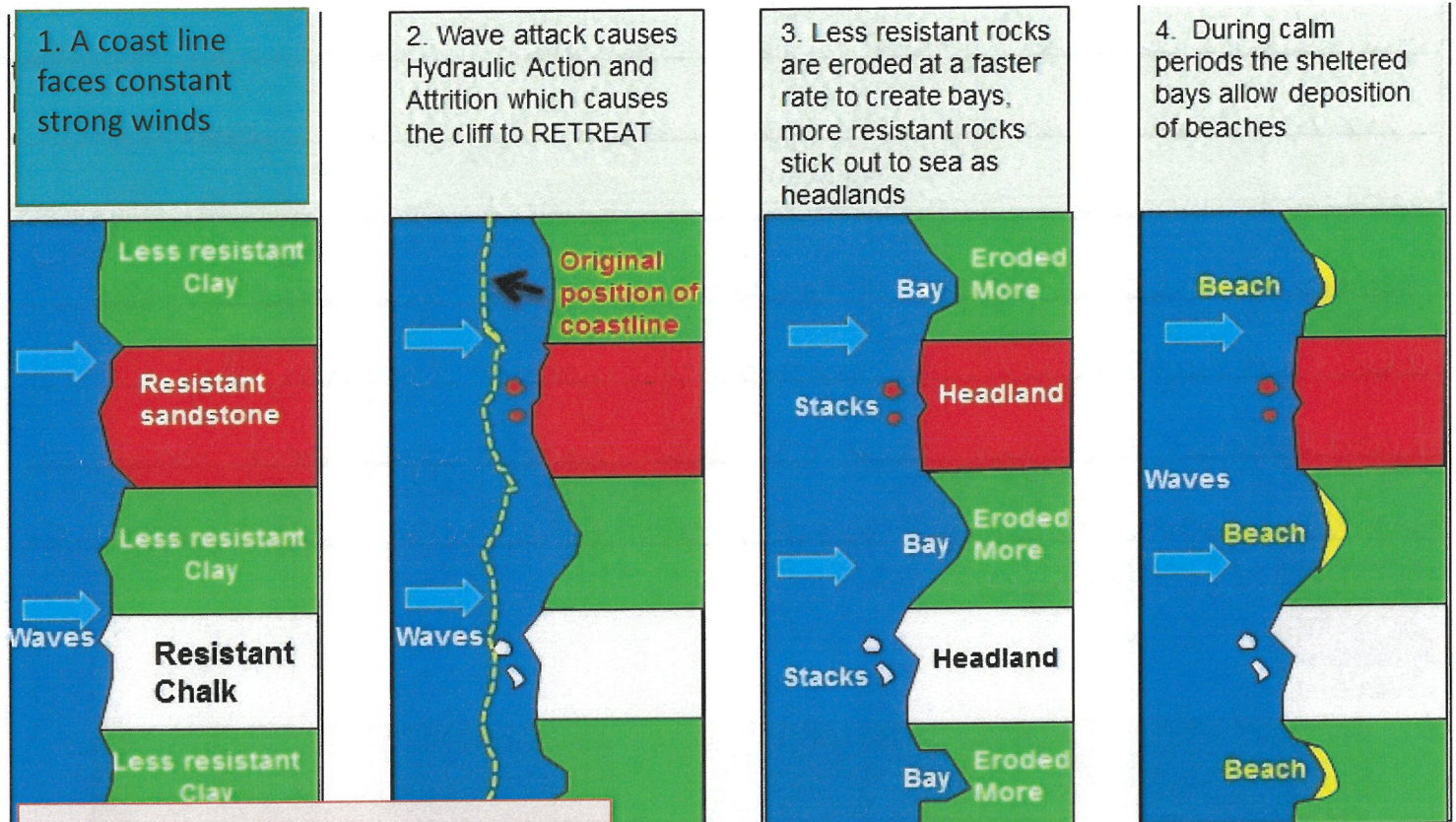
- Erosion
- Transportation
- Deposition

Landforms are created as a result of the rock type and geological structure of the cliffs.

3 types of landforms are often created

1. Headlands and bays
2. Cliffs and wave cut platforms
3. Caves, arches and stacks

## Bays and Headland formation



### Soft Rock:

- ✓ Easily Eroded
- ✓ Include clay, granite and limestone
- ✓ Many parts of the UK are vulnerable to weathering and erosion.

### Hard Rock:

- ✓ Very resistant
- ✓ Includes sandstone, gravel and chalk
- ✓ Rates of erosion would be slow.

Say why or how.

Need to mention hydraulic action etc.

Explain the formation of bays and headlands in relation to coastal erosion.

→ hard / ← soft rock.

(6 Marks)

Coastlines consist of bands of various geology types. Where there are bands of more resistant (chalk) rock and less resistant rock (boulder clay) will over time form headlands and bays. Through erosion such as hydraulic action and abrasion the waves attack land with destructive force. This removes less resistant rock at a faster rate depositing removed material which create bays. Either side of the bays remain headlands of more resistant material. These are created over millions of years leaving the headlands to jut out to sea and deposited material in the bays form beaches. A discordant coastline is formed.

- 1 I Do
- 2 WE Do
- 3 YOU Do

## GCSE GEOGRAPHY FEEDBACK

WWW:

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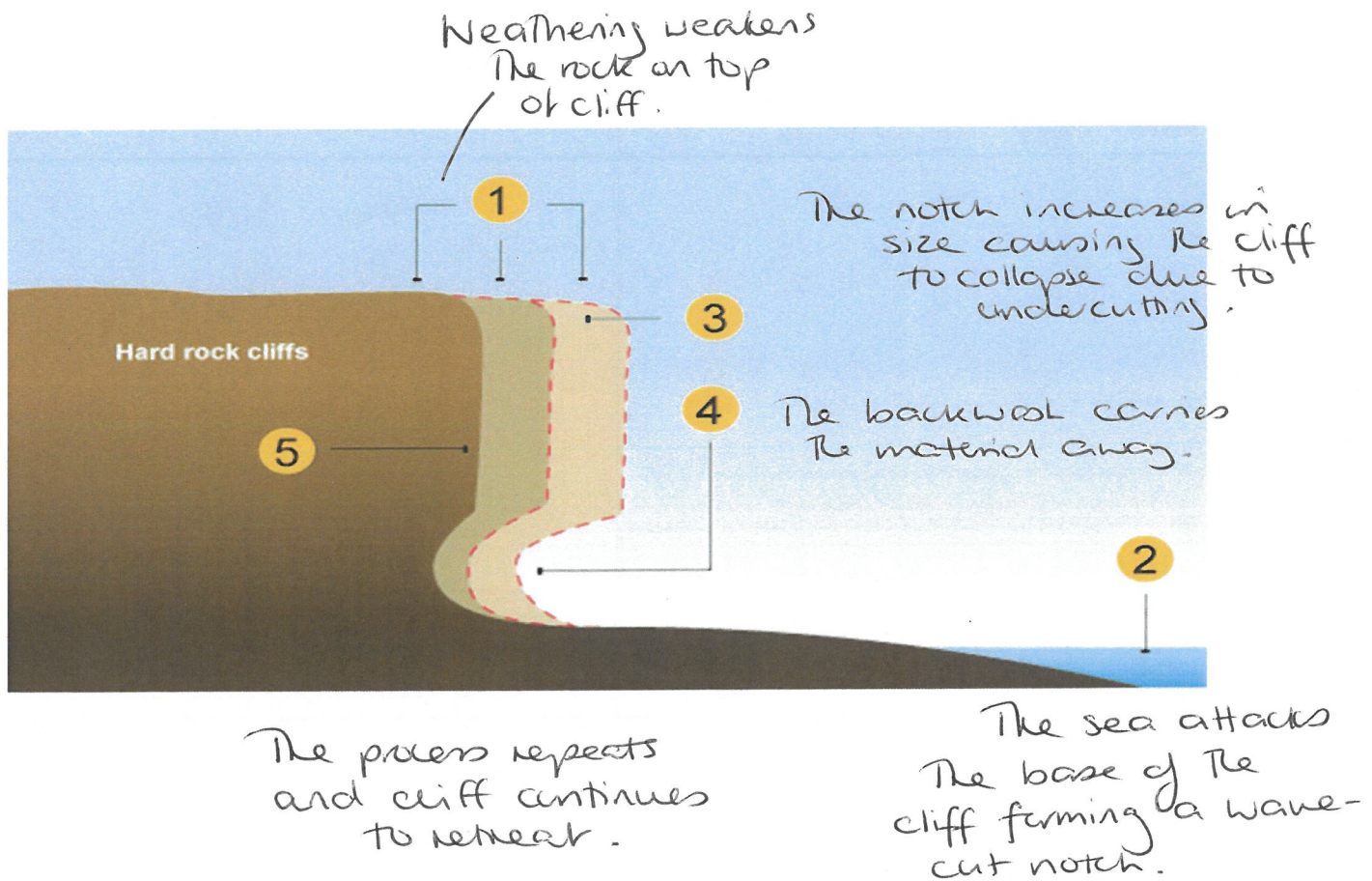
## Cliffs, wave-cut platforms

One of the most common features of a coastline is a cliff. Cliffs are shaped through a combination of erosion and weathering - the breakdown of rocks caused by weather conditions.

Soft rock, eg sand and clay, erodes easily to create gently sloping cliffs. Hard rock, eg chalk, is more resistant and erodes slowly to create steep cliffs.



Label your cliff erosion diagram



**Activate** – Write your answers to the questions in the correct box


*Green pen your answers*