Contents

Getting the most from this book

Exam tips

Advice on key points in the text to help you learn and recall content, avoid pitfalls, and polish your exam technique in order to boost your grade.

Knowledge check

Rapid-fire questions throughout the Content Guidance section to check your understanding.

Knowledge check answers

1 Turn to the back of the book for the Knowledge check answers.

Summaries

- Each core topic is rounded off by a bullet-list summary for quick-check reference of what you need to know.

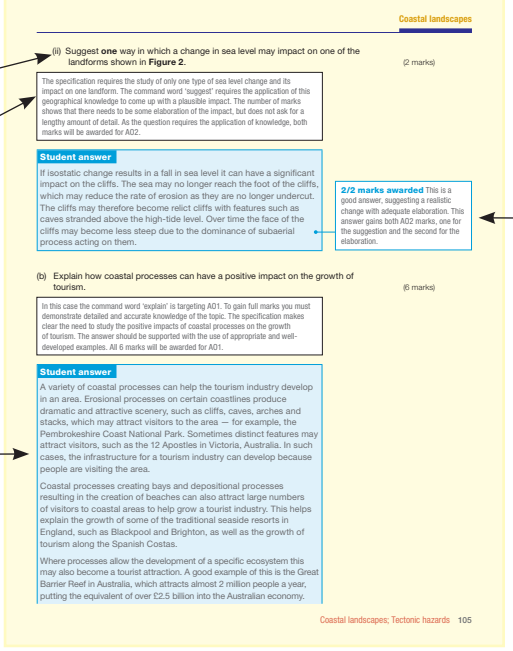
Exam-style questions

Commentary on the questions

Tips on what you need to do to gain full marks.

Sample student answers

Practise the questions, then look at the student answers that follow.



Coastal landscapes

(ii) Suggest **one** way in which a change in sea level may impact on one of the landforms shown in **Figure 2**. (2 marks)

The specification requires the study of only one type of sea level change and its impact on one landform. The command word 'suggest' requires the application of this geographical knowledge to come up with a plausible impact. The number of marks shows that there needs to be some elaboration of the impact, but does not ask for a lengthy amount of detail. As the question requires the application of knowledge, both marks will be awarded for AO2.

Student answer

If isostatic change results in a fall in sea level it can have a significant impact on the cliffs. The sea may no longer reach the foot of the cliffs, which may reduce the rate of erosion as they are no longer undercut. The cliffs may therefore become relict cliffs with features such as caves stranded above the high-tide level. Over time the face of the cliffs may become less steep due to the dominance of subaerial process acting on them.

2/2 marks awarded This is a good answer, suggesting a realistic change with adequate elaboration. This answer gains both AO2 marks, one for the suggestion and the second for the elaboration.

(b) Explain how coastal processes can have a positive impact on the growth of tourism. (6 marks)

In this case the command word 'explain' is targeting AO1. To gain full marks you must demonstrate detailed and accurate knowledge of the topic. The specification makes clear the need to study the positive impacts of coastal processes on the growth of tourism. The answer should be supported with the use of appropriate and well-developed examples. All 6 marks will be awarded for AO1.

Student answer

A variety of coastal processes can help the tourism industry develop in an area. Erosional processes on certain coastlines produce dramatic and attractive scenery, such as cliffs, caves, arches and stacks, which may attract visitors to the area — for example, the Pembrokeshire Coast National Park. Sometimes distinct features may attract visitors, such as the 12 Apostles in Victoria, Australia. In such cases, the infrastructure for a tourism industry can develop because people are visiting the area.

Coastal processes creating bays and depositional processes resulting in the creation of beaches can also attract large numbers of visitors to coastal areas to help grow a tourist industry. This helps explain the growth of some of the traditional seaside resorts in England, such as Blackpool and Brighton, as well as the growth of tourism along the Spanish Costas.

Where processes allow the development of a specific ecosystem this may also become a tourist attraction. A good example of this is the Great Barrier Reef in Australia, which attracts almost 2 million people a year, putting the equivalent of over £2.5 billion into the Australian economy.

Coastal landscapes; Tectonic hazards 105

Commentary on sample student answers

Read the comments showing how many marks each answer would be awarded in the exam and exactly where marks are gained or lost.

About this book

This guide has been designed to help you succeed in WJEC AS and A-level and Eduqas A-level Geography: **Coastal landscapes** and **Tectonic hazards**. The guide has two sections:

The **Content Guidance** summarises the key information that you need to know to be able to answer the examination questions with accuracy and depth. In particular, the meanings of key terms are made clear. You will also benefit by testing your knowledge with knowledge check questions, and noting the exam tips, which provide further help in determining how to learn key aspects of the course.

The **Questions & Answers** section includes sample questions similar in style to those you might expect in the exam. There are sample student responses to these questions as well as detailed commentary giving further guidance in relation to what exam markers are looking for in order to award top marks. The best way to use this book is to read through the relevant topic area first before practising the questions. Refer to the answers and comments only after you have attempted the questions.

The topics covered in this guide are:

Eduqas A-level Component 1: Changing landscapes and changing places

- Section A: Changing landscapes: Coastal landscapes

Eduqas A-level Component 3: Contemporary themes in geography

- Section A: Tectonic hazards

WJEC AS Unit 1: Changing landscapes

- Section A: Changing landscapes: Coastal landscapes
- Section B: Tectonic hazards

WJEC A2 Unit 4: Contemporary themes in geography

- Section A: Tectonic hazards

The formats of the different examination papers are summarised in the table below.

Specification and paper number	Total time for Coastal landscapes/ Tectonic hazards	Total marks for Coastal landscapes/ Tectonic hazards	Structured questions	Extended response/ essay
Eduqas A-level Component 1: Section A Changing landscapes: Coastal landscapes	**50 min** in a paper lasting 1h 45 min	41/82	**Two** compulsory structured data-response questions Marked out of 13	**One** question from a choice of two Marked out of 15
Eduqas A-level Component 3: Section A Tectonic hazards	**40 min** in a paper lasting 2h 15 min	38/128	None	**One** question from a choice of two Marked out of 38
WJEC AS Unit 1: Section A Changing landscapes: Coastal landscapes	**40 min** in a paper lasting 2h	32/96	**Two** compulsory structured data response questions Marked out of 16	None
WJEC AS Unit 1: Section B Tectonic hazards	**80 min** in a paper lasting 2h	64/96	**Three** compulsory structured data response questions Marked out of 22, 24 or 18	None
WJEC A2 Unit 4: Section A Tectonic hazards	**38 min** in a paper lasting 2h	20/64	None	**One** question from a choice of two Marked out of 20

Content Guidance

Coastal landscapes

The operation of the coast as a system

The coastal zone is a dynamic open system. It has inputs and outputs of energy and materials, such as sediment. Every stretch of coastline has stores of materials and energy, and a wide range of processes operate as flows to move these, such as river currents, waves, ocean currents and tides, and atmospheric processes such as wind. These all contribute to dynamic change.

When using systems theory it is often difficult to define the boundaries of the coastal systems (how far inland, how far out to sea). Figure 1 shows the widely accepted **spatial boundaries** of the coastal system. Within the coastal system there are a number of subsystems, such as cliff and beach systems.

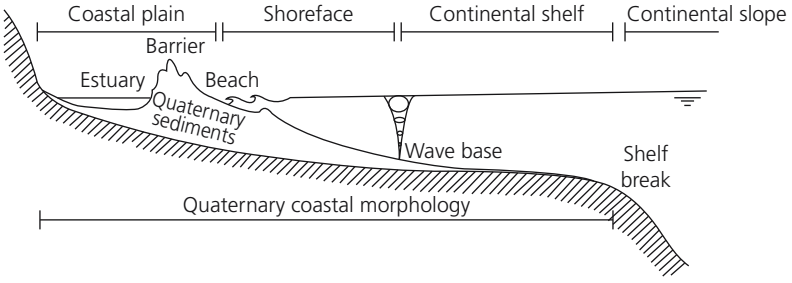


Figure 1 Spatial boundaries of the coastal system

The most useful approach to studying coastal systems includes the **process–response method**, which states that the morphology of any coastal landform is a product of the processes operating in the system (these processes are driven by energy and sediments). **Coastal cliff retreat** is a good example to explain this approach (see page 23).

The coastal sediment budget

Sediment and its movement are critical to the stability of a coastline. In order to manage a length of coastline it is important to know how much sediment is available, where it comes from, where it is stored, and how it leaves a particular coastal section. The identification of these factors is referred to as a **sediment budget** (Figure 2).

Exam tip

Always use appropriate geographical terminology and use a geographical dictionary to define specialist terms.

Knowledge check 1

What are the main inputs in a coastal system?

Knowledge check 2

Why can the coast be classified as an open system?

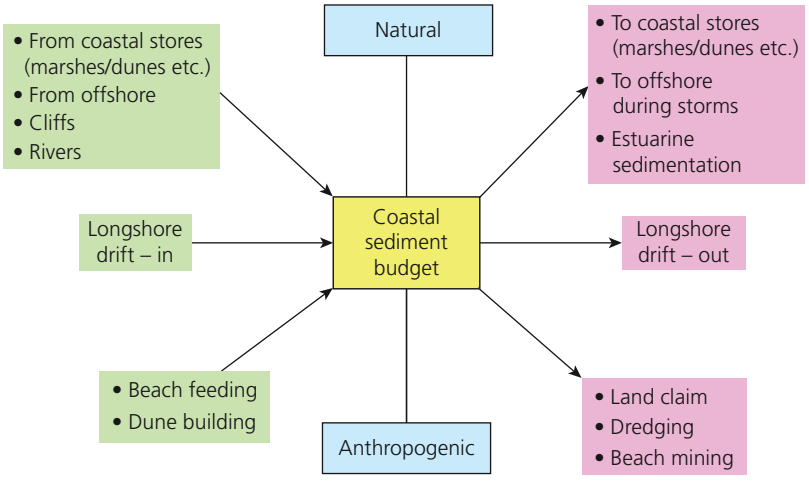


Figure 2 The coastal sediment budget

It is difficult to estimate sediment inputs and outputs, especially when considering sediment movements from and to offshore stores. The significance of each source (input) and output varies according to different coastlines — for example, in 'soft rock' coastlines such as Barton on Sea (pages 55–56), cliffs are the major terrestrial supplier of sediment, but in other parts of the world, such as Bangladesh, fluvial sediment is the dominant supply.

Outputs to the coastal system include longshore drift, loss to offshore, and transfer to sediment stores down the coast. Large volumes of sediment can be temporarily lost to the sediment budget in stores and, similarly, aeolian transfer can be a short-term loss. As Figure 2 shows, anthropogenic losses from beach mining, dredging etc. can also impact on total sediment losses from the system (page 54).

In a balanced budget, input and output volumes should be in equilibrium:

volume of sediment in = volume of sediment stored + volume of sediment out

Human actions, such as building dams or hard engineering coastal defences, can upset the sediment balance, as the inputs suddenly decline. If a replacement sediment source cannot be found, then the following situation will occur:

volume of sediment in < volume of sediment stored + volume of sediment out

This produces a net loss of sediment to the budget, which accelerates erosion. Clearly, beach feeding or nourishment can represent a major input to help balance the sediment budget.

Knowledge check 3

Explain how beach nourishment can help to balance the sediment budget.

Coastal sediment cells

In many countries, **sediment** or **littoral cells** have been identified as units of coastal management, where the dominant processes influencing the sediment budget are generally uniform within a particular coastal stretch. For example, in Wales there are three main sediment and littoral cells, with boundaries formed from the promontories at St David's Head, Bardsey Sound and Great Orme.

- The movement of sand and shingle in the nearshore zone by littoral drift (longshore drift — page 27) has been found to occur in discrete, functionally separate cells. There are 11 major cells for England and Wales (Figure 3), with smaller subcells identified.

Figure 3 The coastal sediment cells in England and Wales

- A major cell is defined as 'a length of coastline and its associated nearshore area, within which the movement of coarse sediments is largely self-contained'.
- Sediment cells are functional systems because there is some movement across longshore drift divides. Littoral cells are therefore open systems.
- Sediment sinks (stores) occur where sediment transport paths meet.

The concept of equilibrium

Coasts are dynamic zones of rapid change. These changes occur frequently and are largely caused by changes in energy conditions. For example, during storms the morphology of the coast responds to changes in energy because it aims to exist in a state of equilibrium, i.e. when the amount of energy entering the coastal system is equal to the energy dissipated. There are three types of equilibrium:

1 **Steady-state equilibrium:** where variations in energy and the morphological response do not deviate far from the long-term average. For example, where and when sea cliffs receive more or less equal

atmospheric and marine energy (e.g. from wind and waves), the profile of the cliff tends to stay the same from year to year, especially for resistant rocks. In the same way, a beach receiving similar amounts of wave energy from one year to the next undergoes seasonal adjustments, but its **average** annual gradient stays the same.

2 **Meta-stable equilibrium:** where an environment switches between two or more states of equilibrium, stimulated by some sort of trigger. For example, the actions of high-energy events, such as storms or a tsunami, which can remove a whole beach in hours, or human actions, such as the construction of a large breakwater or offshore dredging. This can rapidly switch a coastal system from one state of equilibrium to another, for example by removing or supplying large volumes of beach sediment.

3 **Dynamic equilibrium:** this also involves a change in equilibrium conditions but in a much more gradual manner than for meta-stable equilibrium, over a longer time period. A good example is the response of coasts to the gradual post-glacial eustatic rise in sea level, as large amounts of ice from ice sheets and ice caps have melted as a result of climate warming, so that wave energy actions occur higher up the shore, and cliff and beach profiles adjust as a consequence.

Equilibrium as a state does not apply to all coastal areas. Energy environments can change within just a few metres, spatially as well as temporally, which further complicates the issue.

System feedbacks

Understanding states of equilibrium requires some knowledge of feedbacks within the system. Feedbacks occur as the result of change in a system, and they can be either positive or negative, switching the system to a new state of equilibrium or attempting to recover to the system's original state of equilibrium, respectively.

Positive feedbacks therefore **amplify** the initial change in the system so that, for example, the ridge of a coastal sand dune breached by storm wave erosion may be subsequently laterally undercut by wind erosion, thus fragmenting the dune ridge and leaving it susceptible to further wave erosion. Ultimately the whole dune ridge may be driven further inland and a new state of equilibrium reached.

Negative feedbacks diminish or dampen the effect of change. For example, sand eroded during a storm from the front of the embryo and fore dunes at the back of the beach may be redeposited offshore as sand bars, which then help to protect the beach dune system from erosion by slowing waves and dissipating the wave energy reaching the dune front.

Human intervention often leads to apparently unforeseen and undesirable feedbacks, often as a result of inappropriate coastal management.

Knowledge check 4

Explain how the coastal system is in a state of dynamic equilibrium.

Exam tip

There are certain key concepts that you must understand. These include systems, equilibrium and feedback.

Exam tip

The term negative feedback does not mean it has a detrimental effect on the coastal system. It is negative because it reduces the impact of the original change.

Summary

- The coastal system includes inputs, outputs, stores and transfers of energy and materials.
- The sediment budget refers to the amount of sediment available, where it comes from, where it is stored, and how it leaves a particular coastal section.
- Sediment cells are units of coastal management where the dominant processes influencing the sediment budget are uniform within a stretch of coast.
- Coasts are dynamic zones of rapid and frequent change, largely caused by changes in energy conditions, for example during storms.
- Dynamic equilibrium involves a gradual change, over a long time period.

Temporal variations and their influence on coastal environments

Tides, currents and waves are key inputs of energy into the coastal system as they have the potential to erode, transport and deposit material. All three are rapid processes, in that they operate from instantaneous through to annual timescales but rarely on decadal scales, except in terms of cumulative change.

Tides

Tides result from the gravitational attraction on water of the Moon and the Sun, with the Moon having twice the impact of the Sun. All coasts are influenced to some extent by tides, but only a few types of coastline, such as **lowland sandy estuarine coasts**, can be said to be tide-dominated.

Tidal frequency

Most coastlines, such as all open Atlantic coastlines, experience **semi-diurnal** tides, i.e. two high and two low tides approximately every 24 hours. However, some places, such as Antarctica, receive genuinely **diurnal** tides — one high tide and one low tide each day, as a result of local factors.

As the respective motions of the Earth, Moon and Sun go through **regular cycles**, the gravitational forces change and, therefore, so do the tides.

Twice a month the Sun and Moon are aligned, so that their gravitational forces are combined and therefore there is a strong gravitational pull — this leads to above-average tides called **spring tides** that, if combined with strong winds and storms, can cause significant landform changes high up on the shore. Twice a month the Sun and Moon are at right angles with respect to the Earth. As their gravitational forces act in different directions, the overall effects are lessened, so lower-than-average tides result, called **neap tides**. On a biannual basis the largest of the spring tides occur

Questions & Answers

About this section

The questions that follow are typical of the style and structure that you can expect to see in the exam papers. Each question is followed by comments that give some guidance about question interpretation. Student responses are then provided, with further comments indicating the strengths and weaknesses of each answer and the number of marks that would be awarded.

When examiners mark your work, they use a grid that gives the maximum available mark for each assessment objective (AO). The mark scheme will have an indication of what should be included in the answer as well as marking guidance for the criteria required to reach the different mark bands.

You should always make use of examples where appropriate and reference data to support your answers. You can include sketch maps and diagrams where relevant. For AS exams the answers are written in the examination booklet, with the number of lines indicating the level of detail required. When writing in an answer booklet it is important to number your answers in the same way as the examination paper. If you use an extension page you must make a note such as 'continued on page…' at the end of the previous page. Remember to number the question on the extension page.

The formats of the different examination papers for this theme are given in the table on page 5.

Coastal landscapes

Question 1 (WJEC AS format)

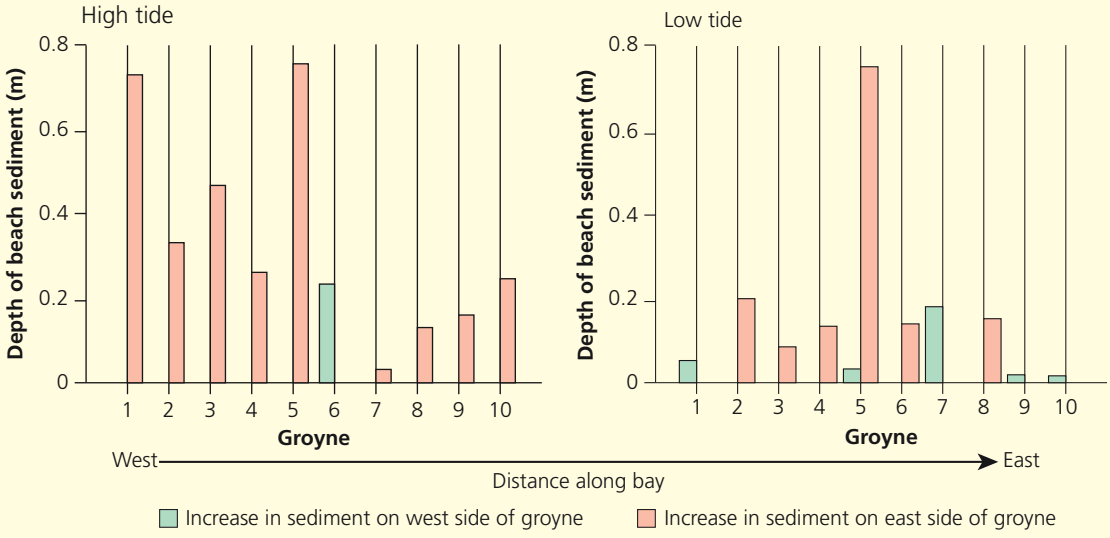


Figure 1 Deposition of beach sediment along a coastal bay in summer

Students measured the difference in the amount of sediment that had been deposited alongside groynes in a bay. They recorded on which side of the groyne the greatest amount of deposition had occurred.

(a) (i) Use **Figure 1** to compare the differences in the deposition of beach sediment in different parts of the bay. (5 marks)

The command word 'compare' is targeting AO3 because it requires the interpretation and analysis of the information in Figure 1. You must provide a point-by-point identification of the similarities and differences shown by the data. You must compare and not simply describe each diagram. All 5 marks will be awarded for your use of skills to interpret and analyse the data (AO3).

Student answer

Apart from groynes 7 and 8, the amount of deposition of sediment is greater in the high-tide zone compared with the low-tide zone. In some cases, such as groynes 1 and 5, there is 0.7 to 0.8 of a metre more sediment. In the high-tide zone all the build-up of sediment is on the eastern side of the groynes apart from groyne 6. This suggests that longshore drift is moving material from east to west. In the low-tide zone the number of groynes with most deposition on the eastern side is equal to the number where most is on the west, suggesting that longshore drift has less of an influence. In the high-tide zone the groynes in the western half of the bay have a much greater level of deposition than the eastern half. This is not so much the case at low tide, where the levels of deposition are similar, apart from the groynes at each end of the bay and groyne 5.

5/5 marks awarded This answer provides a thorough comparison of the two sets of data. It makes clear the differences and similarities in the amount of deposition as well as its location in relation to the side of the groyne and general location in the bay. Most comparisons are made using simple comparative terms such as greater, and there is correct use made of compass direction and one use is made of figures from the graph. This is more successful than writing a description of the high-tide zone followed by a description of low-tide, leaving the examiner to make the comparisons. At least five valid points have been made, so 5/5 marks for AO3 are awarded.

(ii) Suggest why a similar survey taken at the end of winter provided very different results. (3 marks)

In this question you are required to apply your knowledge and put forward plausible ideas about why there were differences. Therefore, all 3 marks will be awarded for A02. The command word 'suggest' and the 3 marks available indicate that some elaboration is required, but not a lengthy explanation.

Student answer

During the winter there are usually more storms and windier weather than in summer. This can cause there to be more high-energy, destructive waves hitting the beach. These waves move sediment offshore, which may result in less material deposited and the removal of sediment in the high-tide zone, so that there is less of a difference between the high-tide and low-tide zones. Also, there may be a change in the prevailing wind direction during winter and as a result longshore drift may change direction or be reduced, resulting in less difference between the two sides of the groynes, especially in the high-tide zone.

3/3 marks awarded This answer shows a good understanding of how conditions influencing a beach may change with the seasons. This knowledge has been used to come up with some realistic explanations for changes that may occur. As at least three valid points have been made, 3/3 marks for A02 are awarded.

(b) Examine the importance of aeolian processes in the formation of a coastal sand dune. (8 marks)

The term aeolian is used in the specification and so its meaning should be understood. This question requires you to demonstrate your knowledge and understanding of the formation of a sand dune (A01). The use of the command word 'examine' indicates the need to consider the interrelationships involved in sand dune formation and evaluate the role played by aeolian processes (A02). An answer should be supported with the use of a relevant example or examples. In this type of question, marks are not split evenly between the AOs. 5 marks will be awarded for the demonstration of your knowledge and understanding (A01) and 3 marks for how you apply this knowledge to the question (A02).

Student answer

A coastal sand dune is formed when winds blow onshore at the required velocity to be able to move sand particles inland by the process of creep and saltation. If there is an obstacle such as a rock or plant, this can reduce the speed of the wind so that the sand is no longer transported and begins to build up. Over time, more deposition may result in dunes and a ridge being formed, such as those at Studland in Dorset. It can be seen therefore that aeolian processes are important as without them the sand would not be transported inland.

However, there are a number of other conditions that need to be met in order for sand dune formation to occur. First, there must be an abundant supply of sand for the wind to move, deposited in the area by constructive waves. For example, the sand dunes along the Camargue coast of France are supplied with sediment carried by the River Rhone to the sea, which is then moved along the coast by currents.

In order for the wind to be able to move the sand easily, there needs to be a shallow beach gradient where a large area is uncovered at low tide, allowing the sand to dry out. There must also be an area where the blown sand can build up and where vegetation can become established to help stabilise the forming dunes.

Where all these conditions are present, it is possible for a sand dune system to form. It can therefore be assumed that aeolian processes are the most important factor required in sand dune formation. However, the formation is also dependent on a number of other factors without which the aeolian processes would have less impact.

6/8 marks awarded This is a competent attempt to establish the role of different factors in sand dune formation. It demonstrates a good level of knowledge by highlighting that factors other than aeolian are necessary, and attempts to demonstrate the interrelationship between the factors while also noting the premier role played by wind. There is some use of examples, although these are a little limited. Evidence from either Studland or the Camargue coast could have been used to show the necessity of other factors rather than just sediment supply. This has had an impact on the AO1 mark, limiting it to band 2. This answer is awarded 3/5 marks for AO1 and 3/3 marks for AO2.

Question 2 (Eduqas A-level format)

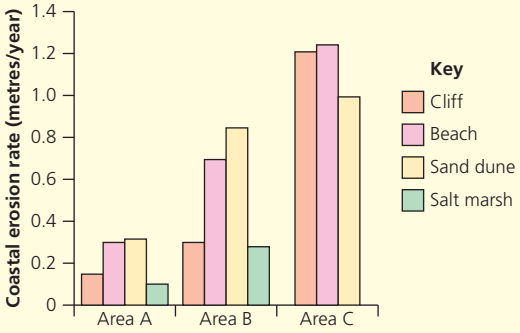


Figure 2 Erosion rates of different coastal landforms in three areas along the Canadian coast

(a) (i) Use **Figure 2** to analyse the variations in the rates of erosion at the locations on the Canadian coast. (5 marks)

The command word 'analyse' is targeting AO3, requiring you to interpret the data. You need to make clear the essential differences and should refer to the data as part of your answer. All 5 marks will be awarded for the interpretation and analysis of the diagram (AO3).

Student answer

The rates of coastal erosion vary greatly between the three areas and also between the types of landform. The fastest rates of erosion occur in Area C, where the rates for cliffs and beaches are almost 1 metre a year faster. However, the rate for salt marsh is zero, although it may be because there is no salt marsh in that area. The slowest rates of erosion are in Area A, possibly because this area of coastline receives fewer high-energy waves than the others.

The unconsolidated material of beach and sand dunes erode much faster, apart from in Area C where cliffs also erode at a similar rate, possibly due to the rock type forming the cliffs. Salt marsh erodes at the slowest rate in all three areas, although it is only slightly slower than the rate of cliff erosion in Area B.

3/5 marks awarded This answer provides quite a well-developed analysis of the variations by looking at similarities and differences not only by area, but also by the type of coastal landform. This provides a better analysis than just describing the rates of each area in turn. It suggests some reasons for the differences but does not go into great detail, which is in line with the command word used. Some use is made of figures from the graph, but more could be made to fully show the scale of the variations. This answer achieves band 2 and is awarded 3/5 marks for AO3.

(ii) Suggest **one** way in which a change in sea level may impact on one of the landforms shown in **Figure 2**. (2 marks)

The specification requires the study of only one type of sea level change and its impact on one landform. The command word 'suggest' requires the application of this geographical knowledge to come up with a plausible impact. The number of marks shows that there needs to be some elaboration of the impact, but does not ask for a lengthy amount of detail. As the question requires the application of knowledge, both marks will be awarded for AO2.

Student answer

If isostatic change results in a fall in sea level it can have a significant impact on the cliffs. The sea may no longer reach the foot of the cliffs, which may reduce the rate of erosion as they are no longer undercut. The cliffs may therefore become relict cliffs with features such as caves stranded above the high-tide level. Over time the face of the cliffs may become less steep due to the dominance of subaerial process acting on them.

2/2 marks awarded This is a good answer, suggesting a realistic change with adequate elaboration. This answer gains both AO2 marks, one for the suggestion and the second for the elaboration.

(b) Explain how coastal processes can have a positive impact on the growth of tourism. (6 marks)

In this case the command word 'explain' is targeting AO1. To gain full marks you must demonstrate detailed and accurate knowledge of the topic. The specification makes clear the need to study the positive impacts of coastal processes on the growth of tourism. The answer should be supported with the use of appropriate and well-developed examples. All 6 marks will be awarded for AO1.

Student answer

A variety of coastal processes can help the tourism industry develop in an area. Erosional processes on certain coastlines produce dramatic and attractive scenery, such as cliffs, caves, arches and stacks, which may attract visitors to the area — for example, the Pembrokeshire Coast National Park. Sometimes distinct features may attract visitors, such as the 12 Apostles in Victoria, Australia. In such cases, the infrastructure for a tourism industry can develop because people are visiting the area.

Coastal processes creating bays and depositional processes resulting in the creation of beaches can also attract large numbers of visitors to coastal areas to help grow a tourist industry. This helps explain the growth of some of the traditional seaside resorts in England, such as Blackpool and Brighton, as well as the growth of tourism along the Spanish Costas.

Where processes allow the development of a specific ecosystem this may also become a tourist attraction. A good example of this is the Great Barrier Reef in Australia, which attracts almost 2 million people a year, putting the equivalent of over £2.5 billion into the Australian economy.