**Q1.** Outline characteristics of high energy coasts.

**[3 marks]**

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**Q2.** Which of the following outlines a positive feedback at the coast?

**[1 mark]**

|  |  |  |
| --- | --- | --- |
| **A** | Erosion occurs at the base of a cliff → a wave-cut platform begins to form → erosion extends the platform → waves have further to travel and lose energy → erosion decreases. |  |
| **B** | Vegetation begins to grow in sediments of saltmarshes → vegetation traps more sediment → height of the marsh increases → length of time inundated by the sea reduces → vegetation growth increases. |  |
| **C** | Storms erode sediment from a beach → sediment deposited as offshore bars → waves break earlier → erosion reduces → after the storm, waves return sediment to the beach. |  |
| **D** | Waves erode the base of a cliff → undercutting leaves the cliff unsupported → cliff collapses leaving debris at the base → cliff is protected from powerful waves → rates of erosion are reduced. |  |

**Q3. Figure 1** is a photograph of part of the Mersey Estuary at Runcorn, Cheshire in 2019.

**Figure 1**

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Note: Runcorn lies about 25 kilometres from the sea on the south bank of the tidal estuary of the River Mersey where the tidal range can be as high as 9 metres. This particular photograph was taken at low tide looking towards the north bank of the estuary. The River Mersey ends its approximately 110 km course in this tidal estuary.

Using **Figure 1** and your own knowledge, assess the view that deposition is the most important factor in the development of this landscape.

**[6 marks]**

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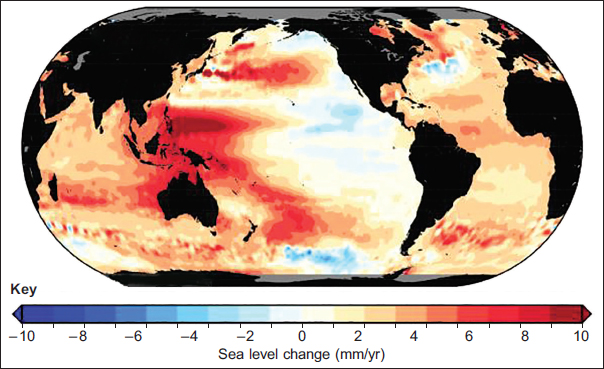
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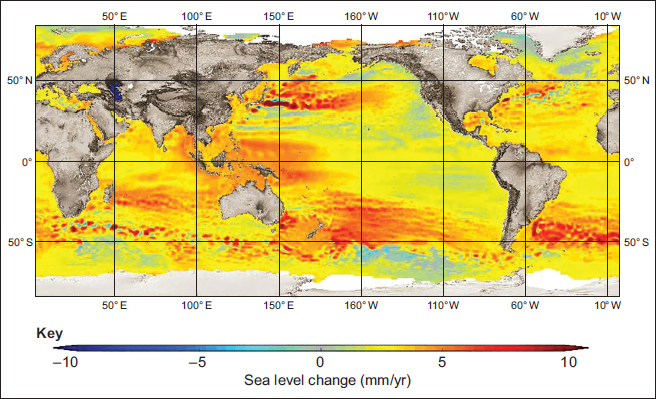
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**Q4. Figure a   
Geographical variation in the 1992–2014 global sea level change using satellite data**

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**Figure b   
Geographical variation in the 1992–2019 global sea level change using another source of satellite data**

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Using only **Figures a** and **b**, evaluate the relative usefulness of these sources in demonstrating eustatic sea level change.

**[6 marks]**

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**Q5.** Assess the importance of different sources of energy in the creation of coastal landscapes.

**[9 marks]**

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**Q6.** Explain the concept of the sediment cell.

**[4 marks]**

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**Q7.** ‘Submergent coastal landforms will develop faster than emergent features in the future.’

To what extent do you agree with this statement?

**[20 marks]**

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**Q8.** Using the information below and your own knowledge, assess the role of mass movement upon the development of this area of the Holderness coastal landscape.

**[6 marks]**

|  |
| --- |
| Holderness is overlaid with unconsolidated glacial deposits which lie on top of chalk.  The landscape is dominated by deposits of till, boulder clays and glacial lake clays.  The glacial deposits form a continuous lowland plain. Rainfall is below national average but the area is prone to heavy storms. |

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**Q9.** Which process / activity can lead to isostatic sea level change?

**[1 mark]**

|  |  |  |
| --- | --- | --- |
| **A** | A global change in sea level. |  |
| **B** | Human activity such as road building or mining. |  |
| **C** | Rotational slumping. |  |
| **D** | The melting of ice sheets on land areas. |  |

**Q10.** Outline the role of wind in affecting coastal energy.

**[3 marks]**

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**Q11.** What is meant by solifluction?

**[1 mark]**

|  |  |  |
| --- | --- | --- |
| **A** | Downslope movement of saturated soils related to the thawing of the active layer. |  |
| **B** | Rock falls resulting from freeze-thaw cycles on steep rock cliffs in glaciated valleys. |  |
| **C** | Slow vertical upwards movement of stones in fine grained soils due to cycles of freezing and thawing. |  |
| **D** | Weathering of a preglacial hollow by physical and chemical processes underneath an accumulation of snow. |  |

**Q14.** How far do you agree that human activity has a greater role than natural processes in shaping coastal landscapes?

**[20 marks]**

**Q15.** Assess the view that wind is the biggest factor in determining the impact of energy in coastal environments.

**[9 marks]**

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**Q16.** What is wave quarrying?

**[1 mark]**

|  |  |  |
| --- | --- | --- |
| **A** | More resistant rocks are pounded against each other in breaking waves causing the breakdown of these materials. |  |
| **B** | Small pebbles and other loose debris are hurled against cliffs by powerful waves causing undercutting. |  |
| **C** | Weak acids contained within seawater gradually erode cliffs in warmer waters. |  |
| **D** | Air is trapped and compressed between a breaking wave and a cliff. The increase in pressure over a period of time causes rock fragments to break off. |  |

**Q17.** Outline characteristics of constructive waves.

**[3 marks]**

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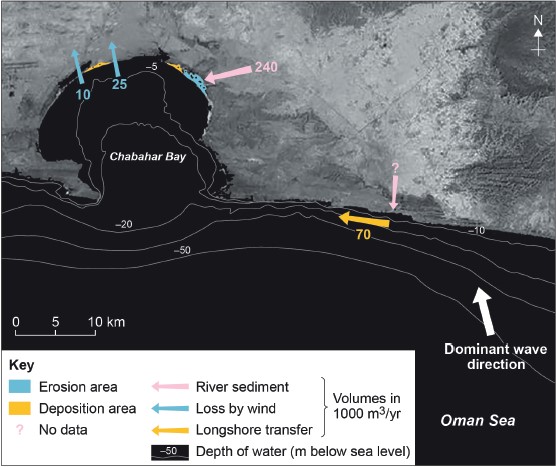
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**Q18.** The photograph below is an image of the coast in the vicinity of Chabahar Bay, Iran. The image focuses on the movement of sediment in this area.



Analyse the data shown in the photograph.

**[6 marks]**

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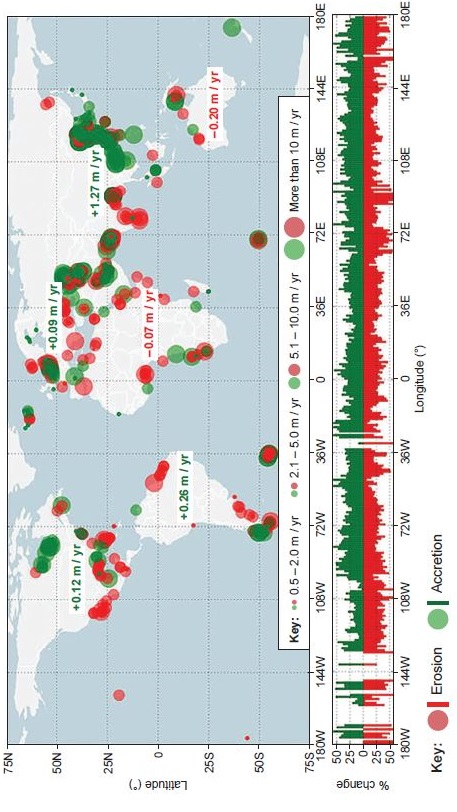
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**Q19. Distribution of beach erosion and accretion from 1984 to 2016**

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The bar graph beneath the map presents the relative occurrence of eroding and accreting sandy shorelines per degree of longitude. The numbers presented on the map represent the average change rate for all sandy shorelines per continent.

The graph shows data related to the distribution of beach erosion and accretion measured from 1984 to 2016. Accretion occurs when more sand is accumulated on beaches than is lost to erosion.

Analyse the data shown in the map and graph above.

**[6 marks]**

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**Q20.** Which process can lead to eustatic sea level change?

**[1 mark]**

|  |  |  |
| --- | --- | --- |
| **A** | Tectonic uplift caused by an earthquake in a localised place. |  |
| **B** | The development of raised beaches. |  |
| **C** | Thermal expansion in the major water bodies. |  |
| **D** | Flooding of coastal landscapes which causes salt marshes and mud flats to develop. |  |

**Q21.** Assess the role of weathering in the development of coastal landforms.

**[9 marks]**

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**Q22.** Assess the relative importance of weathering and erosion in the development of coastal landscapes.

**[20 marks]**

**Q23.** Which of the following are **all** processes of coastal transportation?

**[1 mark]**

|  |  |  |
| --- | --- | --- |
| **A** | Corrasion, hydraulic action, wave quarrying |  |
| **B** | Abrasion, cavitation, attrition |  |
| **C** | Mass movement, runoff, sub-aerial weathering |  |
| **D** | Solution, suspension, traction |  |

**Q24.** How far do you agree that weathering processes make little contribution to the development of landscapes of coastal erosion?

**[9 marks]**

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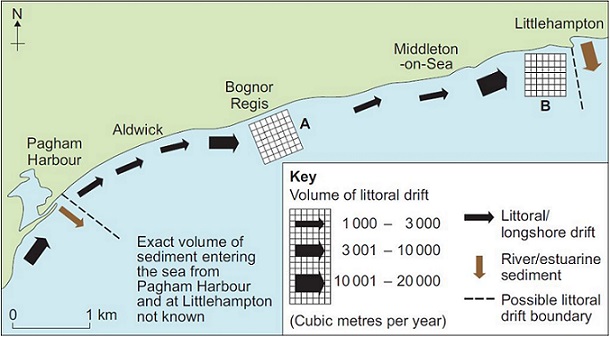
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**Q25.** The map below shows information about the transport of sediment along the West Sussex coast between Pagham Harbour and Littlehampton.



Complete the map above by using the data shown below, and then analyse the data shown in the completed map.

**[6 marks]**

|  |  |
| --- | --- |
| **Location** | **Volume of littoral drift**  (cubic metres per year) |
| **A** | 7 600 |
| **B** | 19 100 |

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**Q26.** What is a sediment cell?

**[1 mark]**

|  |  |  |
| --- | --- | --- |
| **A** | A defined area of coastline, usually between two prominent headlands, where inputs and outputs of sediment are theoretically balanced. |  |
| **B** | A section of coastline for which a certain coastal management strategy has been defined. |  |
| **C** | A stretch of coastline where the different rock layers run parallel to the coast. |  |
| **D** | A zone extending from the low water mark to a water depth of about 15 m that is permanently covered with water. |  |

**Q27.** In systems in physical geography, which of the following correctly defines negative feedback?

**[1 mark]**

|  |  |  |
| --- | --- | --- |
| **A** | Changes in a system amplify, or speed up, the impacts of an initial action. |  |
| **B** | Changes in a system decrease, or slow down, the impacts of an initial action. |  |
| **C** | When there is a balance between the inputs and outputs of a system. |  |
| **D** | When there is a transfer of energy beyond the boundary of the system. |  |

**Q28.** Outline the process of sub-aerial weathering in the development of coastal landscapes.

**[4 marks]**

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**Q29.** Outline the process of coastal hydraulic action.

**[3 marks]**

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**Q31.** Outline the role of waves in the transportation of sediments at the coast.

**[4 marks]**

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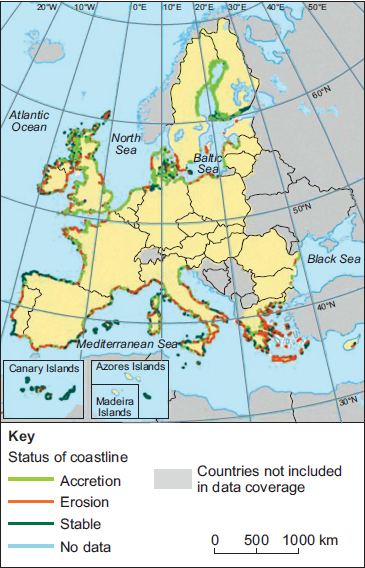
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**Q32.** The map below shows the distribution of coastal erosion and accretion (sediment build up) across selected European coastlines in 2004.



Analyse the data shown in the map above.

**[6 marks]**

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**Q33.** To what extent can an understanding of feedback systems help with the management of **one or more** coastal landscapes that you have studied?

**[20 marks]**

**Q34.** The photograph below shows a landform located in the Humber Estuary, UK.



Note: This landform extends about 5 km across the Humber Estuary and is only 50 metres wide at its narrowest point. The Holderness coastline to the north comprises mainly boulder clay, which is unconsolidated material deposited at the end of the last ice age.

Using the photograph above and your own knowledge, assess the relative importance of factors leading to the development of this landform.

**[6 marks]**

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Mark schemes

**Q1.**

Point marked

Allow 1 mark for each valid point with additional marks for developed points.

Notes for answers

High energy coasts:

•   tend to have exposure to strong and steady prevailing winds (1) that create high energy waves (1)(d).

•   generally have an open uninterrupted aspect with a large fetch (1).

•   tend to have rates of erosion greater than deposition (1).

•   may have greater exposure to tropical storms (1).

•   often have erosional landforms including headlands, cliffs and wavecut platforms (1).

•   experience processes that tend to straighten the coastline (1), with material eroded from headlands being deposited as beaches that ‘smooth-out’ former irregularities in the coastline (1)(d).

**Credit any valid characteristic or feature of high energy coasts**

**AO1 = 3**

**[Total 3 marks]**

**Q2.**

**B** Vegetation begins to grow in sediments of saltmarshes → vegetation traps more sediment → height of the marsh increases → length of time inundated by the sea reduces → vegetation growth increases.

**AO1 = 1**

**[Total 1 mark]**

**Q3.**

**AO1** – Knowledge and understanding of the processes related to the development of mudflats and saltmarshes.

**AO2** – Application of this knowledge to the novel situation; specifically, in accounting for the formation coastal features such as saltmarshes and mudflats.

Mark scheme

**Level 2 (4–6 marks)**

**AO1** – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change.

**AO2** – Applies knowledge and understanding to the novel situation offering clear evaluation and analysis drawn appropriately from the context provided. Connections and relationships between different aspects of study are evident with clear relevance.

**Level 1 (1–3 marks)**

**AO1** – Demonstrates basic knowledge and understanding of concepts, processes, interactions, change.

**AO2** – Applies limited knowledge and understanding to the novel situation offering only basic evaluation and analysis drawn from the context provided. Connections and relationships between different aspects of study are basic with limited relevance.

Notes for answers

**AO1**

•   Sources of energy in coastal environments: winds, waves (constructive and destructive), currents and tides. Low energy coasts.

•   Sediment sources, cells and budgets.

•   Geomorphological processes: transportation and deposition.

•   Origin and development of landforms and landscapes of coastal deposition.

•   Estuarine mudflat / saltmarsh environments and associated landscapes; factors and processes in their development.

**AO2**

•   Clearly deposition is a crucial factor in the development of this landscape. Looking at the information provided, the tide is out and a mudflat is evident. Fine sands and other particles will have been transported from further upstream to be deposited as the river loses energy when it meets the incoming tide. The mudflats are likely to be submerged in large part when the tide comes back in.

•   In the background some should note the presence of vegetation and it is reasonable to assume that this is a saltmarsh. Here the original mudflats will have been colonised by vegetation and trapped more sediment. Over time the saltmarsh has built up so that it is consistently above the high-water mark. In this sense it is the vegetation colonisation which could be argued to be more important in the development of the saltmarsh.

•   Without the influence of the incoming tide, some may argue that the sediment would continue downstream and further into the estuary ie that the tide is the most important factor.

•   The main factors are therefore the sediment deposition, the tidal influence and the colonisation by vegetation. Responses are free to argue for the importance of any factor.

Credit any other valid assessment.

Generic explanation of the formation of mudflats / saltmarshes (with no attempt to apply knowledge to the resource and associated information) should be held to Level 1.

**AO1 = 2, AO2 = 4**

**[Total 6 marks]**

**Q4.**

**AO3** – Analysis of the map evidence to identify patterns, anomalies and using data manipulation to support response.

Mark scheme

**Level 2 (4–6 marks)**

**AO3** – Clear analysis of the quantitative evidence provided, which makes appropriate use of evidence in support. Clear connection(s) between different aspects of the evidence.

**Level 1 (1–3 marks)**

**AO3** – Basic analysis of the quantitative evidence provided, which makes limited use of evidence in support. Basic connection(s) between different aspects of the evidence.

Notes for answers

**AO3**

•   There are clear similarities between the two sources. Both tend to show the similar information in relation to sea level change.

•   Some may note the variation in date range for the data collection and use this to explain the potential variation between the two sources. This is a legitimate approach.

•   Both show similar swathes of ocean area experiencing similar change. For example, there is a band of ocean experiencing increasing sea levels of up to 5mm/yr north of the 50o south line of latitude. This is similar though not identical on both figures.

•   **Figure a** appears to offer a larger range of change with some areas (eg south east of South America), experiencing substantial drops in sea level (up to 6–8 mm/yr) compared to **Figure b** which does not show quite the same extreme with a drop of less than 5mm / yr.

•   Many are likely to conclude that **Figure b** is more current and offers much greater clarity in displaying the sea level change information. Equally though for the area around south-east Asia **Figure a** suggests much higher increases compared to **Figure b**.

Credit any other valid evaluation.

**AO3 = 6**

**[Total 6 marks]**

**Q5.**

**AO1** − Demonstrates knowledge and understanding of sources of coastal energy. Knowledge and understanding of coastal landscape development.

**AO2** − Application of knowledge and understanding to analyse and evaluate how the energy available from different sources has a direct impact upon the emerging landscape.

Mark scheme

**Level 3 (7−9 marks)**

**AO1** − Demonstrates detailed knowledge and understanding of concepts, processes, interactions and change. These underpin the response throughout.

**AO2** − Applies knowledge and understanding appropriately with detail. Connections and relationships between different aspects of study are fully developed with complete relevance. Analysis and evaluation are detailed and well supported with appropriate evidence.

**Level 2 (4−6 marks)**

**AO1** − Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy.

**AO2** − Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Analysis and evaluation are evident and supported with clear and appropriate evidence.

**Level 1 (1−3 marks)**

**AO1** − Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy.

**AO2** − Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Analysis and evaluation are basic and supported with limited appropriate evidence.

Notes for answers

**AO1**

•   Sources of energy in coastal environments: winds, waves (constructive and destructive), currents and tides. Low energy and high energy coasts.

•   Systems in physical geography: systems concepts and their application to the development of coastal landscapes − inputs, outputs, energy, stores / components, flows / transfers, positive / negative feedback, dynamic equilibrium. The concepts of landform and landscape and how related landforms combine to form characteristic landscapes.

•   Geomorphological processes: weathering, mass movement, erosion, transportation and deposition.

•   Origin and development of landforms and landscapes of coastal erosion: cliffs and wave cut platforms, cliff profile features including caves, arches and stacks; factors and processes in their development.

•   Origin and development of landforms and landscapes of coastal deposition. Beaches, simple and compound spits, tombolos, offshore bars, barrier beaches and islands and sand dunes; factors and processes in their development.

•   Named low and high energy coastlines are likely to support responses.

**AO2**

•   Evaluation − For energy, responses will most likely refer to wind, waves, currents and tides and how these shape the coastline. The key is that responses assess the importance of the energy in the development of the coastal landscape of choice.

•   Analysis − High energy environments are characterised by strong winds and a large fetch, which generate strong currents and more destructive waves. These waves attack exposed coastlines, usually cliff lined, where the water is deep and the waves can attack unimpeded by shallow water. Expect to see reference to geos, arches, caves, stacks and stumps as characteristic landforms created in these environments. The assessment here should really note the importance of wind in this regard which in turn affects wave power.

•   Analysis − Some responses may assess the importance of constructive versus destructive waves and link this to the development of associated coastal landscapes. As long as the focus is on the importance of the energy source in the development of the landscape, this is a valid approach.

•   Analysis − Others may consider the direction of the prevailing wind in assessing importance of sources of energy. Provided other conditions exist at the coastline (such as shallow water and a sediment supply), this may be linked to the development of beaches and spits. Again the wind is the critical factor in the development of this landscape. These low energy environments are characterised by low wind speeds or calm conditions in sheltered environments. Waters tend to be shallow and constructive waves dominate. The swash is more powerful than backwash and sediments are pushed up the beaches in bays. Expect to see reference to beaches and bays. Some may link this to longshore drift and the formation of spits where local factors allow the formation of such features.

•   Analysis − Tides may also feature as an important energy supply. Responses may consider estuaries and the development of mud flats and salt marshes. Tides may also be linked to prevailing weather conditions and where low pressure and high tides coincide storm surges may cause significant erosion including cliff collapse. This line of reasoning would constitute a more sophisticated response.

•   Overall evaluation − as long as there is some clear direction provided from preceding content, assessment may consider any energy source as important. Wind should be a strong feature as this is the major driver.

**AO1 = 4, AO2 = 5**

**[Total 9 marks]**

**Q6.**

Allow 1 mark per valid point with extra mark(s) for developed points (d).

**AO1**

•   A sediment cell is a closed system usually bounded by headlands or a change in longshore drift (1).

•   Within a sediment cell, there is erosion, transport and deposition of sediment within a long term cycle (1).

•   The only inputs into the sediment come from erosion from the sea bed or land (1).

•   There is little or no movement of sediment between cells (1).

•   Human activity such as beach management can interrupt the natural system creating imbalance within the cell leaving some areas at risk of erosion (1).

**AO1 = 4**

**[Total 4 marks]**

**Q7.**

**AO1** – Knowledge and understanding of submergent and emergent coastal landforms. Knowledge and understanding of predicted future sea level change.

**AO2** – Application of knowledge and understanding to assess the extent to which global sea level rise will outpace any local scale isostatic uplift.

Notes for answers

**AO1**

•   Eustatic, isostatic and tectonic sea level change: major changes in the sea level in the last 10 000 years.

•   Coastlines of emergence and submergence. Origin and development of associated landforms: raised beaches, marine platforms; rias, fjords, Dalmatian coasts.

•   Recent and predicted climate change and potential impact on coasts.

•   The relationship between process, time, landforms and landscapes in coastal settings.

**AO2**

•   Application of knowledge and understanding to assess the scale and role of key future processes, including: predicted sea level change; isostatic rebound; tectonic processes.

•   It is likely that responses will come to the view that the answer depends on the geographical scale at which the question is addressed.

-   Globally, eustatic sea level rise will undoubtedly lead to the accelerating development of submergent features in most parts of the world.

-   More locally, in areas where isostatic rebound is already occurring, or where it begins to happen in the future as more ice on land melts, outcomes will reflect the balance between rates of sea level rise and uplift of land.

-   In some places it is possible that major seismic events could rapidly lead to either uplift or submergence of the land at the coast.

•   Expect responses to come to the view that the accelerating rate at which global sea levels are predicted to rise in the 21st Century and beyond it is most likely that submergent features will develop faster than emergent features.

•   Responses may also come to the view that much will depend upon the rate, and extent, to which humans are able to mitigate both the causes and impacts of future climate change.

•   It is possible, although unlikely, that a response may make reference to the fact that Earth is currently in an interglacial and, at some point, there is likely to be another period of climatic cooling and sea level fall. This is valid.

Any conclusion is acceptable, though should relate to the preceding content.

**Level 4 (16–20 marks)**

•   Detailed evaluative conclusion that is rational and firmly based on knowledge and understanding which is applied to the context of the question (AO2).

•   Detailed, coherent and relevant analysis and evaluation in the application of knowledge and understanding throughout (AO2).

•   Full evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).

•   Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout (AO1).

•   Full and accurate knowledge and understanding of key concepts and processes throughout (AO1).

•   Detailed awareness of scale and temporal change which is well-integrated where appropriate (AO1).

**Level 3 (11–15 marks)**

•   Clear evaluative conclusion that is based on knowledge and understanding which is applied to the context of the question (AO2).

•   Generally clear, coherent and relevant analysis and evaluation in the application of knowledge and understanding (AO2).

•   Generally clear evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).

•   Generally clear and relevant knowledge and understanding of place(s) and environments (AO1).

•   Generally clear and accurate knowledge and understanding of key concepts and processes (AO1).

•   Generally clear awareness of scale and temporal change which is integrated where appropriate (AO1).

**Level 2 (6–10 marks)**

•   Some sense of an evaluative conclusion partially based upon knowledge and understanding which is applied to the context of the question (AO2).

•   Some partially relevant analysis and evaluation in the application of knowledge and understanding (AO2).

•   Some evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).

•   Some relevant knowledge and understanding of place(s) and environments which is partially relevant (AO1).

•   Some knowledge and understanding of key concepts, processes and interactions and change (AO1).

•   Some awareness of scale and temporal change which is sometimes integrated where appropriate. There may be a few inaccuracies (AO1).

**Level 1 (1–5 marks)**

•   Very limited and/or unsupported evaluative conclusion that is loosely based upon knowledge and understanding which is applied to the context of the question (AO2).

•   Very limited analysis and evaluation in the application of knowledge and understanding. This lacks clarity and coherence (AO2).

•   Very limited and rarely logical evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).

•   Very limited relevant knowledge and understanding of place(s) and environments (AO1).

•   Isolated knowledge and understanding of key concepts and processes.

•   Very limited awareness of scale and temporal change which is rarely integrated where appropriate. There may be a number of inaccuracies (AO1).

**Level 0**

Nothing worthy of credit.

**AO1 = 10, AO2 = 10**

**[Total 20 marks]**

**Q8.**

**AO1** − Knowledge and understanding of the process of mass movement, its causes and associated landforms.

**AO2** − Application of this knowledge to the novel situation; specifically the aspects of rotational slumping and sliding. Clearly links the process to the development of the landscapes.

Mark scheme

**Level 2 (4−6 marks)**

**AO1** − Demonstrates clear knowledge and understanding of concepts, processes, interactions and change.

**AO2** − Applies knowledge and understanding to the novel situation offering clear analysis and evaluation drawn appropriately from the context provided. Connections and relationships between different aspects of study are evident with clear relevance.

**Level 1 (1−3 marks)**

**AO1** − Demonstrates basic knowledge and understanding of concepts, processes, interactions, change.

**AO2** − Applies limited knowledge and understanding to the novel situation offering basic analysis and evaluation drawn from the context provided. Connections and relationships between different aspects of study are basic with limited relevance.

Notes for answers

**AO1**

•   The geomorphological process of mass movement to include sliding and slumping.

•   Landforms / landscapes associated with mass movement.

•   Origin and development of landforms and landscapes of coastal deposition.

**AO2**

•   Analysis and evaluation of the novel situation; specifically the aspects of rotational slumping and sliding. Clearly links the process to the development of this landscape.

•   Expect responses to examine the factors which may have led to mass movement. Whilst definitions are not required some will provide these. The key is the link between the mass movement process and the associated landscape. Some may consider the role of mass movement in modifying the shape and appearance of cliffs or other features such as the beach.

•   Consideration of rotational slumping or sliding which is an aspect of mass movement and again changes the shape of the cliff line by reducing the cliff angle.

•   Factors combine to cause the mass movement; most notably the unconsolidated materials (glacially deposited materials) which form the basis of a coastline experiencing such change; and the prevailing weather or climatic conditions which often leave the soil saturated causing the slump or slide to occur, mainly due to the lack of friction or resistance to collapse.

**AO1 = 2, AO2 = 4**

**[Total 6 marks]**

**Q9.**

D

**AO1 = 1**

**[Total 1 mark]**

**Q10.**

Allow one mark per valid point with additional credit for development.

**AO1** − Wind is responsible for the generation of waves as friction occurs at the surface of the water (1). Stronger winds blowing for a longer distance will generate bigger more powerful / destructive waves (d)(1). Wind also affects currents in terms of the direction that wind is blowing in (1). This has a direct bearing upon the potential for longshore drift depending upon the angle that the waves hit the coastline (1).

**AO1 = 3**

**[Total 3 marks]**

**Q11.**

A

**AO1 = 1**

**[Total 1 mark]**

**Q14.**

**AO1** − Knowledge and understanding of the role of human activity in coastal landscapes. Knowledge and understanding of the natural processes which shape coastlines.

**AO2** − Applies knowledge and understanding to come to an evaluative conclusion as to whether it is human activity or natural processes which have a more significant role.

Notes for answers

**AO1**

•   Eustatic, isostatic and tectonic sea level change: major changes in sea level in the last 10,000 years.

•   Recent and predicted climatic change and potential impact on coasts.

•   The relationship between process, time, landforms and landscapes in coastal settings.

•   Origin and development of landforms and landscapes of coastal erosion: cliffs and wave cut platforms, cliff profile features including caves, arches and stacks; factors and processes in their development.

•   Human intervention in coastal landscapes. Traditional approaches to coastal flood and erosion risk: hard and soft engineering. Sustainable approaches to coastal flood risk and coastal erosion management: shoreline management / integrated coastal zone management.

•   Case study of a coastal landscape to illustrate and analyse how it presents risks and opportunities for human occupation and development and evaluate human responses of resilience, mitigation and adaptation.

**AO2**

•   Candidates are free to argue in any direction in relation to the question. Some may remain neutral.

•   Some may argue human activity is having considerable activity upon coastlines. Coastal management can have a dramatic impact upon coastal landscapes. A variety of approaches may be considered in relation to hard engineering, soft engineering and managed retreat. Some may also legitimately consider the impact of coastal management in one place upon other stretches of coastline within the same sediment cell.

•   Responses may also consider development and economic activity taking place at the coastline. Provided there is a clear link to how this is shaping the coastal landscape this is a legitimate approach.

•   In terms of natural processes expect consideration of tectonic, eustatic and isostatic change as well as erosion, transport and depositional processes. There should be recognition that these processes have a direct bearing upon specific landform development and wider landscape development. Expect to see reference to coastal landscapes of erosion and / or deposition.

•   Consideration of the cause of the erosional landscapes and features such as caves, arches, stacks and stumps are likely to feature. Responses taking this approach should consider the role of specific erosional processes such as abrasion attrition, hydraulic action, and solution. Some aspects of geology may also feature. Similarly depositional features such as beaches and spits and the factors leading to their formation may also feature. Factors leading to the development of dunes are also permissible i.e. onshore winds, a sediment source and clearly developed intertidal zone.

•   For eustatic change, more sophisticated responses may see the link between human activity and natural processes and consider these two elements in conjunction with each other i.e. that it is the human activity which is exacerbating the eustatic sea level change that is currently being experienced.

•   Responses are likely to be supported by specific examples to support the position taken i.e. places where natural processes have been dominant in shaping the landscape as compared with other places where human activity has been dominant in shaping the landscape.

**Level 4 (16−20 marks)**

•   Detailed evaluative conclusion that is rational and firmly based on knowledge and understanding which is applied to the context of the question. Interpretations are comprehensive, sound and coherent (AO2).

•   Detailed, coherent and relevant analysis and evaluation in the application of knowledge and understanding throughout (AO2).

•   Full evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).

•   Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout (AO1).

•   Full and accurate knowledge and understanding of key concepts, processes and interactions and change throughout (AO1).

**Level 3 (11−15 marks)**

•   Clear evaluative conclusion that is based on knowledge and understanding which is applied to the context of the question. Interpretations are generally clear and support the response in most aspects (AO2).

•   Generally clear, coherent and relevant analysis and evaluation in the application of knowledge and understanding (AO2).

•   Generally clear evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).

•   Generally clear and relevant knowledge and understanding of place(s) and environments (AO1).

•   Generally clear and accurate knowledge and understanding of key concepts, processes and interactions and change (AO1).

**Level 2 (6−10 marks)**

•   Some sense of an evaluative conclusion partially based upon knowledge and understanding which is applied to the context of the question (AO2). Interpretations are partial but do support the response in places.

•   Some partially relevant analysis and evaluation in the application of knowledge and understanding (AO2).

•   Some evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).

•   Some relevant knowledge and understanding of place(s) and environments which is partially relevant (AO1).

•   Some knowledge and understanding of key concepts, processes and interactions and change. There may be a few inaccuracies (AO1).

**Level 1 (1−5 marks)**

•   Very limited and/or unsupported evaluative conclusion that is loosely based upon knowledge and understanding which is applied to the context of the question (AO2). Interpretation is basic.

•   Very limited analysis and evaluation in the application of knowledge and understanding. This lacks clarity and coherence (AO2).

•   Very limited and rarely logical evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).

•   Very limited relevant knowledge and understanding of place(s) and environments (AO1).

•   Isolated knowledge and understanding of key concepts, processes and interactions and change. There may be a number of inaccuracies. (AO1).

**Level 0 (0 marks)**

•   Nothing worthy of credit.

**AO1 = 10, AO2 = 10**

**[Total 20 marks]**

**Q15.**

**AO1** − Demonstrates knowledge and understanding of sources coastal energy. Knowledge and understanding of coastal landscape development.

**AO2** − Application of knowledge and understanding to analyse and evaluate the role of wind in relation to other factors affecting coastal energy.

Mark scheme

**Level 3 (7−9 marks)**

**AO1** − Demonstrates detailed knowledge and understanding of concepts, processes, interactions and change. These underpin the response throughout.

**AO2** − Applies knowledge and understanding appropriately with detail. Connections and relationships between different aspects of study are fully developed with complete relevance. Analysis and evaluation is detailed and well supported with appropriate evidence.

**Level 2 (4−6 marks)**

**AO1** − Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy.

**AO2** − Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Analysis and evaluation is evident and supported with clear and appropriate evidence.

**Level 1 (1−3 marks)**

**AO1** − Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy.

**AO2** − Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Analysis and evaluation is basic and supported with limited appropriate evidence.

Notes for answers

**AO1**

•   Sources of energy in coastal environments: winds, waves (constructive and destructive), currents and tides. Low energy and high energy coasts.

•   Systems in physical geography: systems concepts and their application to the development of coastal landscapes − inputs, outputs, energy, stores / components, flows / transfers, positive / negative feedback, dynamic equilibrium.

•   Geomorphological processes: weathering, mass movement, erosion, transportation and deposition.

•   Named low and high energy coastlines are likely to support responses.

**AO2**

•   Wind should be considered as a key factor is determining the impact of coastal energy. Where the distance of open water over which the wind travels is great, then larger, more destructive waves are created. This is synonymous with high energy environments.

•   Wind should be considered along with other factors. Some may consider the combined effects of storms and high tides, which when combined with the spring high tide have the potential to create storm surges. Others may consider tropical storms in this regard.

•   Local coastal geomorphology also has a part to play in determining the impact of energy. Some may consider bays, headlands and wave refraction. Coastline with deep water is more likely to be high energy as there no frictional drag exerted by the sea bed and there is nothing to dissipate wave energy. Wave refraction means that the full force of the waves is directed upon the headland. Bays and beaches have the opposite effect. The shallow water dissipates wave energy. Estuaries tend to be lower energy environments but can also be affected by waves such as the Severn Bore. This is formed in very particular tidal conditions and only occurs where there are very particular geomorphological characteristics.

•   Others may consider currents as a factor affecting coastal energy. Depending upon the direction of the current and the angle at which waves strike the coast can also determine whether longshore drift occurs and sediments move along the coast. This itself is connected to wind and that link should be made.

•   Responses may conclude that it is the interaction of different factors which determines the impact of coastal energy rather than any single factor. Others may conclude in favour of wind as the most significant factor. Any approach is valid provided it is coherently argued.

**AO1 = 4, AO2 = 5**

**[Total 9 marks]**

**Q16.**

D

**AO1 = 1**

**[Total 1 mark]**

**Q17.**

Allow one mark per valid point with additional credit for development.

Minimum of two characteristics for full marks.

**AO1**

•   Constructive waves have a long wave length i.e. horizontal distance between two peaks (1).

•   They have a low amplitude i.e. vertical height or distance between peak and normal sea level (1).

•   They are also characterised as having a stronger swash than backwash (1).

•   They have a longer wave period i.e. time taken to travel through one wave cycle (1).

**AO1 = 3**

**[Total 3 marks]**

**Q18.**

**AO3** − Analysis of the map evidence to show understanding of sediment transport around this sediment cell.

Mark scheme

**Level 2 (4−6 marks)**

**AO3** − Clear analysis of the quantitative evidence provided, which makes appropriate use of evidence in support. Clear connection(s) between different aspects of the evidence.

**Level 1 (1−3 marks)**

**AO3** − Basic analysis of the quantitative evidence provided, which makes limited use of evidence in support. Basic connection(s) between different aspects of the evidence.

Notes for answers

**AO3**

•   This is a coastline which is being affected by longshore drift. The sediment cell is approximately 50-60 km long and the longshore current is moving sediment from east to west. The dominant wave direction is north, north-west. It suggests that waves must be hitting the coastline at a slight angle moving the sediment in a westerly direction.

•   There appears to be no coastal protection in place and significant quantities of material are being moved annually − 70,000 m3 from the eastern end of the littoral cell. This suggests that erosion should be occurring at the eastern end as there is no apparent sediment input from rivers or from further along the eastern edge of the coastline.

•   The sediments appear to be being moving in an anti-clockwise direction around the bay. There is a significant input of sediment (240,000 m3) into the bay presumably as a result of river deposition. This continues to be circulated around the bay in an anti-clockwise direction. The river itself may be causing erosion in the bay. There is a zone of erosion at the point where the river meets the bay and just a little further east there is a zone of deposition.

•   Significant quantities of material appear to be lost to wind erosion as the sediment is blown inland. This is occurring in the north-west of Chabahar Bay.

•   Overall the bay is experiencing significantly more deposition than erosion due the contribution of longshore transported material and the input from the river.

**AO3 = 6**

**[Total 6 marks]**

**Q19.**

**AO3** – Analysis of the map evidence to identify patterns, anomalies and using data manipulation to support response.

Mark scheme

**Level 2 (4–6 marks)**

**AO3** – Clear analysis of the quantitative evidence provided, which makes appropriate use of evidence in support. Clear connection(s) between different aspects of the evidence.

**Level 1 (1–3 marks)**

**AO3** – Basic analysis of the quantitative evidence provided, which makes limited use of evidence in support. Basic connection(s) between different aspects of the evidence.

Notes for answers

**AO3**

•   There is significant variation in the rates of accretion and erosion of sandy beaches across the world.

•   Overall, across the continents, beaches are experiencing net gains, most notably in south-east Asia. This area is experiencing accretion rates over 1m / yr greater than any other continent.

•   Some may argue that in terms of longitudinal analysis, there is some evidence of mirroring i.e. where rates are high for erosion, there is some evidence that rates are also high for accretion and vice versa.

•   Some may suggest that this is not the case and point to anomalies such as 30°W or 144°W. At 30°W for example, there is evidence of erosion running at over 50% with accretion at only around 5–10%.

•   In terms of locational patterns there are some distinct bands where erosion is dominant (e.g. India or the band stretching from the Mediterranean to east coast of Africa). There are some bands of significant accretion e.g. south east Asia and northern Canada.

•   Some may question the usefulness of the resource. There are areas where it is very hard to tell which process is dominant and how much erosion or accretion is taking place e.g. Middle East.

**Credit any other valid analysis.**

**AO3 = 6**

**[Total 6 marks]**

**Q20.**

C

**AO1 = 1**

**[Total 1 mark]**

**Q21.**

**AO1** − Demonstrates knowledge and understanding of geomorphological processes of weathering. Knowledge and understanding of the development of coastal landforms.

**AO2** − Application of knowledge and understanding to analyse how different processes of weathering operating over different timescales have direct impacts on the development of distinctive coastal landforms.

**Level 3 (7−9 marks)**

**AO1** − Demonstrates detailed knowledge and understanding of concepts, processes, interactions and change. These underpin the response throughout.

**AO2** − Applies knowledge and understanding appropriately with detail. Connections and relationships between different aspects of study are fully developed with complete relevance. Analysis is detailed and well-supported with appropriate evidence.

**Level 2 (4−6 marks)**

**AO1** − Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy.

**AO2** − Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Analysis is evident and supported with clear and appropriate evidence.

**Level 1 (1−3 marks)**

**AO1** − Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy.

**AO2** − Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Analysis is basic and supported with limited appropriate evidence.

Notes for answers

**AO1**

•   Geomorphological processes of weathering. The specification does not specify named processes, but expect reference to processes of biological, chemical and physical / mechanical weathering.

•   Systems in physical geography: systems concepts and their application to the development of coastal landscapes − inputs, outputs, energy, stores / components, flows / transfers, positive / negative feedback, dynamic equilibrium. The concepts of landform and landscape and how related landforms combine to form characteristic landscapes.

•   Distinctively coastal processes: Sub-aerial weathering. The specification does not specify named processes, but expect reference to processes of biological, chemical and physical / mechanical weathering.

•   Origin and development of landforms of coastal erosion: cliffs and wave cut platforms, cliff profile features including caves, arches and stacks; factors and processes in their development.

•   Origin and development of landforms of coastal deposition. Beaches, simple and compound spits, tombolos, offshore bars, barrier beaches and islands and sand dunes; factors and processes in their development.

•   The relationship between process, time, landforms and landscapes in coastal settings.

**AO2**

•   Assessment − Responses may follow a sequence to illustrate how coastal processes create coastal landforms.

•   Assessment − Responses will refer to processes of weathering in the context of the coastal setting, with evaluation of the role of processes involved. Some may seek to highlight how weathering differs to other coastal processes such as erosion, transportation, deposition and mass-movement.

•   Assessment − Responses may assess how processes of weathering can be responsible for creating coastal landforms themselves, which contribute to distinctive coastal landscapes.

•   Assessment − Responses may consider the role of processes of weathering such as; mechanical or physical weathering, biological weathering, and various forms of chemical weathering. Assessment of the above will seek to show the extent to which they break down *in situ* the underlying rocks of the coastline, and the contribution this makes to the sequence of landform development.

•   Assessment − The processes of weathering identified thus changes the shape and character of characteristic coastal landforms. Responses may suggest that coastal cliffs might be most obviously affected by such processes.

•   Assessment − Some responses will assess the role weathering plays in contributing to the development of coastal landforms alongside other coastal processes. Including how weathering can weaken coastal landforms such as cliffs making them more susceptible to processes of coastal erosion. Weathering also adds sediment to the shoreline which can then be used by other coastal processes: material can be picked up by waves and the wind and be used as agents of erosion, other material can be picked up by both waves and wind and via processes of coastal transportation moved and deposited elsewhere.

•   Assessment − some responses will also assess the role weathering plays in the formation of landforms of coastal erosion and deposition.

•   The key is that there is clear assessment of the link between the processes of weathering and the formation of coastal landforms.

**AO1 = 4, AO2 = 5**

**[Total 9 marks]**

**Q22.**

**AO1** − Knowledge and understanding of the processes associated with weathering and erosion. Knowledge and understanding of the role of these processes in landscape development.

**AO2** − Application of knowledge and understanding to assess the relative importance of these processes in different contexts; specifically in relation to landscape development.

Notes for answers

**AO1**

•   Sources of energy in coastal environments: winds, waves (constructive and destructive), currents and tides. Low energy and high energy coasts.

•   Sediment sources, cells and budgets.

•   Geomorphological processes: weathering, mass movement, erosion, transportation and deposition.

•   Distinctively coastal processes: marine: erosion – hydraulic action, wave quarrying, corrasion / abrasion, cavitation, solution, attrition; transportation: traction, suspension (longshore / littoral drift) and deposition; sub-aerial weathering, mass movement and runoff.

•   Origin and development of landforms and landscapes of coastal erosion: cliffs and wave cut platforms, cliff profile features including caves, arches and stacks; factors and processes in their development.

•   Case studies of coastal environments at a local scale to illustrate and analyse fundamental coastal processes and their landscape outcomes.

**AO2**

•   Weathering and associated mass movement is particularly important in explaining the development of a number of coastal locations in the UK and abroad. The decisive factor in determining the extent to which mass movement is a dominant process is often the local geology and other physical geographical conditions. There are many different types of mass movement arising out of weathering processes and erosion. These processes vary depending upon location. Many will consider rotational slumping and / or sliding. Here the rock type is a decision factor.

•   In 1999, Vargas Sate in Venezuela experienced a coastal mud slide. This was as a direct result of prevailing weather conditions and local geology. Heavy rains fell in December 1999 along the north-central coast of Venezuela. Runoff entered channels and rushed towards the sea, picking up sediments along its course. These rains triggered shallow landslides which stripped soil and rock off the landscape and sent them slipping down the steep slopes towards the sea. The additional water liquefied these landslides into debris flows. Over 10,000 people are known to have died in this single event. This evidence suggests that weathering and associated mass movements act entirely independently of coastal processes.

•   Others may refer to the process of soil creep which again acts independently of any coastal processes and is more likely created by gravity moving soils and sediments downslope with moisture provided as a lubricant.

•   At Barton on Sea, there is an example of erosion and weathering working together in the process of cliff collapse. The cliffs are composed of gravels, sands and clays. This means that they are easily eroded and have little strength to resist collapse. The gravels and sands, being permeable created a slip plane. They absorbed rainwater, whereas the clay is impermeable. This combined with the undercutting caused a rotational slump and cliff collapse.

•   Similarly, at Beachy Head in 1999 a huge landslide occurred. This was a product of the combined impact of weathering processes operating sub aerially and coastal erosion caused by strong waves pounding the base of the cliff causing undercutting and vibrations.

•   For coastlines of erosion expect to see reference to places such as the south coast of the UK and the concordant and discordant geology found the Purbeck region. Here there is a combination of high energy, powerful waves with a large fetch. There is a lack of coastal defence and beaches / shallow water to protect the coastline. As a result, erosion dominates the landscape development in this area. However even here weathering is also shaping the landscape. Old Harry stack is experiencing subaerial weathering and will eventually fall into the sea as a result of this process and the continued undercutting of the stack.

•   The concept of landscape should emerge in responses. Reference to individual landforms rather than the assembly of landforms associated with landscape development is likely to be a feature of a lower end response.

Whatever the approach there should be some acknowledgements that along most coastlines, both types of process are acting upon the coastline to shape and develop the landscape features.

There should also be some assessment of relative importance.

**Level 4 (16−20 marks)**

•   Detailed evaluative conclusion that is rational and firmly based on knowledge and understanding which is applied to the context of the question. Interpretations are comprehensive, sound and coherent (AO2).

•   Detailed, coherent and relevant analysis and evaluation in the application of knowledge and understanding throughout (AO2).

•   Full evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).

•   Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout (AO1).

•   Full and accurate knowledge and understanding of key concepts, processes and interactions and change throughout (AO1).

**Level 3 (11−15 marks)**

•   Clear evaluative conclusion that is based on knowledge and understanding which is applied to the context of the question. Interpretations are generally clear and support the response in most aspects (AO2).

•   Generally clear, coherent and relevant analysis and evaluation in the application of knowledge and understanding (AO2).

•   Generally clear evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).

•   Generally clear and relevant knowledge and understanding of place(s) and environments (AO1).

•   Generally clear and accurate knowledge and understanding of key concepts, processes and interactions and change (AO1).

**Level 2 (6−10 marks)**

•   Some sense of an evaluative conclusion partially based upon knowledge and understanding which is applied to the context of the question (AO2). Interpretations are partial but do support the response in places.

•   Some partially relevant analysis and evaluation in the application of knowledge and understanding (AO2).

•   Some evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).

•   Some relevant knowledge and understanding of place(s) and environments which is partially relevant (AO1).

•   Some knowledge and understanding of key concepts, processes and interactions and change. There may be a few inaccuracies (AO1).

**Level 1 (1−5 marks)**

•   Very limited and / or unsupported evaluative conclusion that is loosely based upon knowledge and understanding which is applied to the context of the question (AO2). Interpretation is basic.

•   Very limited analysis and evaluation in the application of knowledge and understanding. This lacks clarity and coherence (AO2).

•   Very limited and rarely logical evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).

•   Very limited relevant knowledge and understanding of place(s) and environments (AO1).

•   Isolated knowledge and understanding of key concepts, processes and interactions and change. There may be a number of inaccuracies (AO1).

**Level 0 (0 marks)**

•   Nothing worthy of credit.

**AO1 = 10, AO2 = 10**

**[Total 20 marks]**

**Q23.**

D

**AO1 = 1**

**[Total 1 mark]**

**Q24.**

**AO1** Knowledge and understanding of subaerial weathering processes. Knowledge and understanding of the development of landscapes of coastal erosion.

**AO2** Application of knowledge and understanding to assess the extent to which subaerial weathering processes contribute to the development of landscapes of coastal erosion.

Notes for answers

**AO1**

•   Geomorphological processes: weathering, mass movement, erosion, transportation and deposition.

•   Distinctively coastal processes: marine: erosion – hydraulic action, wave quarrying, corrasion/abrasion, cavitation, solution, attrition; transportation: traction, suspension (longshore/littoral drift) and deposition; sub-aerial weathering, mass movement and runoff.

•   The relationship between process, time, landforms and landscapes in coastal settings.

•   Origin and development of landforms and landscapes of coastal deposition. Beaches, simple and compound spits, tombolos, offshore bars, barrier beaches and islands and sand dunes; factors and processes in their development.

•   Origin and development of landforms and landscapes of coastal erosion: cliffs and wave cut platforms, cliff profile features including caves, arches and stacks; factors and processes in their development.

•   Systems in physical geography: systems concepts and their application to the development of coastal landscapes – inputs, outputs, energy, stores/components, flows/transfers, positive/negative feedback, dynamic equilibrium. The concepts of landform and landscape and how related landforms combine to form characteristic landscapes.

•   Case study(ies) of coastal environment(s) at a local scale to illustrate and analyse fundamental coastal processes, their landscape outcomes as set out above and engage with field data and challenges represented in their sustainable management.

**AO2**

•   It is likely that many responses will reach the view that weathering processes do indeed make little contribution to the development of landscapes of coastal erosion. However, some responses could reach the opposite conclusion and come to the view that weathering plays a significant role in the development of landscapes of coastal erosion.

•   Responses may come to the view that the extent of the contribution that weathering processes make to the development of landscapes of coastal erosion is dependent on a range of other factors.

•   Other factors that the contribution of weathering processes may be assessed against could include factors such as: processes of erosion, processes of deposition, the geology of the coast, the impact of wave action, the climate of the coastal area.

•   It is likely that the contribution of weathering processes may be assessed in the context of specific landscape features, for example: In the context of a section of coastal landscape composed of a sequence of erosional landforms including a cave, arch and stack, may conclude that weathering plays a significant role by working in tandem with processes of erosion. Where processes of chemical weathering, physical and biological weathering may weaken the rock and thus allow erosion to proceed more easily.

•   Equally some responses may come to the view that weathering processes make little contribution to the development of landscapes of coastal erosion with illustrated support. Some responses may suggest that subaerial processes operate above the influence of waves, and thus erosional processes, so landscape features that are formed below the high watermark may mainly be developed by wave action.

The key is that there is clear assessment of the extent to which the candidate believes that weathering processes make little contribution to the development of landscapes of coastal erosion. A clear view is expected.

Credit any other valid assessment.

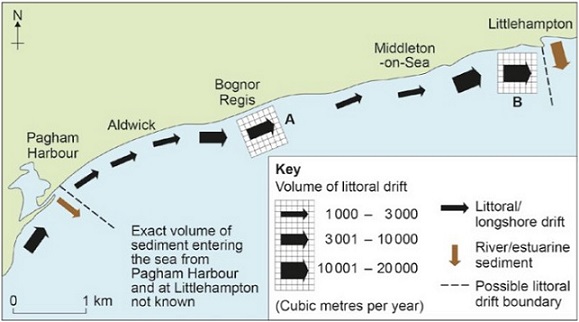
**AO1 = 4, AO2 = 5**

**[Total 9 marks]**

**Q25.**

Mark scheme

2 × 1 per accurate plot



Notes for answers

Allow 1 mark for each valid point with additional marks for developed points.

•   Littoral / longshore drift operates from west to east along the coast (1).

•   The largest flows of sediment occur over the 2km west of Littlehampton with up to twice the amount of sediment flowing past both sites than at any other site (1).

•   Assessing the exact volumes of sediment flows is difficult due to the large ranges used for each class of data in the key (1).

•   Rates of sediment flow fluctuate west to east between Pagham Harbour and Littlehampton (1), supported with appropriate use of data (1d).

•   Flow rates passing the first three recording sites to the east of Pagham Harbour are potentially a 1/10 to a 1/3 of the flow rates at the 4th location just west of Bognor Regis (1). The pattern of flow rates repeats itself to the east of Bognor, with rates of flow in the lowest category for the next 2 recording sites, but significantly higher flow rates at the 3rd and 4th sites, between 1 and 2 km east of Middleton-On-Sea (1).

•   Sediment flow rates are potentially 10 to 20 times higher at the two recording sites to the west of Littlehampton than they are passing any of the other sites (1).

•   Even though the exact volume of sediment entering the sea at Pagham and Littlehampton is not known, the arrows suggest this is significantly lower than the volume of sediment moving along the coast between the two places (1), therefore the majority of sediment moving along the coast must be coming from other sources (1)(d).

•   With limited precise numerical values, points including more sophisticated elements of description may be credited as analysis, especially if they address connections between various aspects of map evidence.

**The Notes for answers are not exhaustive. Credit any valid points**.

**AO3 = 6**

**[Total 6 marks]**

**Q26.**

A

**AO1 = 1**

**[Total 1 mark]**

**Q27.**

B

**AO1 = 1**

**[Total 1 mark]**

**Q28.**

Point marked

Allow 1 mark per valid point with extra mark(s) for developed points (d). For example:

Notes for answers

•   Sub-aerial weathering involves the action of rainwater and insolation upon landforms in the coastal landscape (1).

•   Here material is broken in situ, rocks are weakened and can contribute to sudden large-scale movements (1).

•   Chemical weathering occurs when weak carbonic acid in rainwater attacks limestone cliffs (1). This leads to the formation of karst landscapes (d).

•   Mechanical weathering occurs when repeated freezing and thawing of water absorbed in pervious rock leads to the breakdown of rocks and the emergence of pronounced cracks in the bedding plain and rock strata (1).

•   Biological weathering refers to the burrowing of plants and animals into the rock at the coast. This can lead to the break-up of rock as well as the weakening of the rock by species which attach to rock (1).

Some may refer to processes such as hydration, oxidation, hydrolysis and carbonation.

The Notes for answers are not exhaustive. Credit any valid points.

**AO1 = 4**

**[Total 4 marks]**

**Q29.**

Point marked

Allow 1 mark for each valid point with additional marks for developed points.

Notes for answers

•   This is a process of marine erosion (1).

•   It refers to erosion via the sheer force of water alone without any debris (1).

•   With high energy waves this can exert enormous pressure on the rock surface (1), weakening or breaking off rock particles (1d).

•   It is also referred to as wave pounding (1).

•   Accept reference to cavitation or wave quarrying (1).

The notes for Answers are not exhaustive. Credit any valid points.

**AO1 = 3**

**[Total 3 marks]**

**Q31.**

Point marked

Allow 1 mark per valid point with extra mark(s) for developed points (d). For example:

Notes for answers

•   Constructive waves tend to bring sediments on to the beach (1). This is due to the low energy nature of these wave (1) (d). They tend to have low frequency, height and limited backwash (1) (d). The swash is therefore a key factor in bringing sediments onshore (1) (d).

•   Destructive waves tend to remove sediments from beaches and coastlines (1). They have a powerful backwash, higher frequency and greater wave height(1) (d). The backwash is instrumental in transporting material back out to sea, sometimes deposited at an offshore bar (1) (d).

•   Longshore drift is the gradual movement of sediments along a coastline (1) (d). Where waves strike the coast at an angle, sediments are moved up the beach at that same angle with the swash (1) (d). The backwash returns sea water and sediments perpendicular to the coastline (1) (d). Repeated wave action in this way moves sediments along parallel to the coastline (1) (d).

The notes for answers are not exhaustive. Credit any valid points.

**AO1 = 4**

**[Total 4 marks]**

**Q32.**

**AO3** – Analysis of the map evidence to identify patterns, anomalies and using data manipulation to support response.

Mark scheme

**Level 2 (4–6 marks)**

**AO3** – Clear analysis of the quantitative evidence provided, which makes appropriate use of evidence in support. Clear connection(s) between different aspects of the evidence.

**Level 1 (1–3 marks)**

**AO3** – Basic analysis of the quantitative evidence provided, which makes limited use of evidence in support. Basic connection(s) between different aspects of the evidence.

Notes for answers

**AO3**

•   The overall picture is very mixed across the European coastlines.

•   There are large areas experiencing accretion, particularly around northern Europe.

•   The picture around the Jutland peninsula is hard to decipher and somewhat unclear. Expect candidates to question the clarity of the resource in this area. The picture is mixed here with what looks like more accretion than erosion.

•   Some may suggest that more exposed coastlines are eroding, but this pattern is far from certain. There is some evidence in support in places such as the west coast of Ireland and Portugal.

•   The Mediterranean coastlines are almost all either eroding or stable with only small pockets of accretion such as in northern Italy.

•   It is interesting to note that the islands of Madeira and the Canaries are both exposed coastlines but experiencing stability.

Credit any other valid analysis.

**AO3 = 6**

**[Total 6 marks]**

**Q33.**

**AO1** – Knowledge and understanding of systems operating in coastal landscapes. Awareness of coastal management strategies.

**AO2** – Application of knowledge and understanding to assess the extent to understanding of feedback systems can be utilised in helping to combat erosion flooding as well as to protect habitats.

Notes for answers

**AO1**

•   Systems in physical geography: systems concepts and their application to the development of coastal landscapes – inputs, outputs, energy, stores/components, flows/transfers, positive/negative feedback, dynamic equilibrium. The concepts of landform and landscape and how related landforms combine to form characteristic landscapes.

•   Human intervention in coastal landscapes. Traditional approaches to coastal flood and erosion risk: hard and soft engineering. Sustainable approaches to coastal flood risk and coastal erosion management: shoreline management/integrated coastal zone management.

•   Case study(ies) of coastal environment(s) at a local scale to illustrate and analyse fundamental coastal processes and challenges represented in their sustainable management.

•   Case study of a contrasting coastal landscape beyond the UK to illustrate and analyse how it presents risks and opportunities for human occupation and development and evaluate human responses of resilience, mitigation and adaptation.

**AO2**

•   Expect to see responses set out a clear understanding of the concept of positive and negative feedback in coastal systems.

•   At the coastline there are many examples of both positive and negative feedback. The coastal management philosophy aims to respond to change in the system by aiming to restore natural balance at the coastline. Coastal management therefore seeks to exploit the concept and application of naturally occurring negative feedback in the coastal system. Management also seeks to counteract the exacerbating and damaging impact of positive feedback which takes the system further and further away from equilibrium.

•   Expect to see a combination of place based case studies and / or exemplification through evaluation of shoreline management / integrated coastal zone management plans.

•   For example, Holderness is already one of the fastest eroding coastlines in the world, receding by up to 2 metres per year. Sea level change threatens to further exacerbate this by creating a positive feedback loop. As sea levels are predicted to rise this will further erode coastlines. This combined with naturally occurring processes such as longshore drift will expose the coastline to even further erosion. Without intervention stability will only be created when the boulder clay has been removed completely, with more resistant chalk lying further inland. Clearly this would be intolerable to local communities but also economically. As a result, substantial coastal management has been employed to restore equilibrium eg by installing sea walls, rip rap and groynes to resist erosion and create artificial beaches.

•   In terms of integrated coastal zone management schemes, the key underpinning philosophy is one of bringing all relevant stakeholders together to consider a sustainable future for the coastal which responds to change, always seeking to restore balance. One example is the Pegaso Project, an Integrated coastal management strategy in the Mediterranean. Reports have highlighted numerous examples of entire coastlines that have experienced exceptionally high waves, severe floods, or large shoreline erosions among other natural coastal impacts, all examples of potential positive feedback. Floods for example, accounted for 35% of all natural disasters that hit the Mediterranean. Italy and Romania are among the countries that had experienced an increasing number of severe floods. Besides the possible effects of climate change, growing uncontrolled coastal urbanisation, and construction of coastal infrastructures, land use changes and deforestation are the main reasons creating higher sensitivity on the part of coastal zones to these events. The purpose of the ICZM in this context is to address the underlying positive feedback and return the coast to a more stable equilibrium in a sustainable fashion for all stakeholders.

•   In summary, whatever the context, expect most responses to agree that understanding feedback is essential to sustainable coastal management.

Credit any other valid approach. Evaluation should be based upon preceding content.

**Level 4 (16–20 marks)**

•   Detailed evaluative conclusion that is rational and firmly based on knowledge and understanding which is applied to the context of the question. Interpretations are comprehensive, sound and coherent (AO2).

•   Detailed, coherent and relevant analysis and evaluation in the application of knowledge and understanding throughout (AO2).

•   Full evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).

•   Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout (AO1).

•   Full and accurate knowledge and understanding of key concepts, processes and interactions and change throughout (AO1).

•   Detailed awareness of scale and temporal change which is well integrated where appropriate (AO1).

**Level 3 (11–15 marks)**

•   Clear evaluative conclusion that is based on knowledge and understanding which is applied to the context of the question. Interpretations are generally clear and support the response in most aspects (AO2).

•   Generally clear, coherent and relevant analysis and evaluation in the application of knowledge and understanding (AO2).

•   Generally clear evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).

•   Generally clear and relevant knowledge and understanding of place(s) and environments (AO1).

•   Generally clear and accurate knowledge and understanding of key concepts, processes and interactions and change (AO1).

•   Generally clear awareness of scale and temporal change which is integrated where appropriate (AO1).

**Level 2 (6–10 marks)**

•   Some sense of an evaluative conclusion partially based upon knowledge and understanding which is applied to the context of the question (AO2). Interpretations are partial but do support the response in places.

•   Some partially relevant analysis and evaluation in the application of knowledge and understanding (AO2).

•   Some evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).

•   Some relevant knowledge and understanding of place(s) and environments which is partially relevant (AO1).

•   Some knowledge and understanding of key concepts, processes and interactions and change. There may be a few inaccuracies (AO1).

•   Some awareness of scale and temporal change which is sometimes integrated where appropriate. There may be a few inaccuracies (AO1).

**Level 1 (1–5 marks)**

•   Very limited and/or unsupported evaluative conclusion that is loosely based upon knowledge and understanding which is applied to the context of the question. Interpretation is basic (AO2).

•   Very limited analysis and evaluation in the application of knowledge and understanding. This lacks clarity and coherence (AO2).

•   Very limited and rarely logical evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).

•   Very limited relevant knowledge and understanding of place(s) and environments (AO1).

•   Isolated knowledge and understanding of key concepts, processes and interactions and change. There may be a number of inaccuracies. (AO1).

•   Very limited awareness of scale and temporal change which is rarely integrated where appropriate. There may be a number of inaccuracies (AO1).

**Level 0 (0 marks)**

•   Nothing worthy of credit.

**AO1 = 10, AO2 = 10**

**[Total 20 marks]**

**Q34.**

**AO1** – Knowledge and understanding of the processes related to the development of spits.

**AO2** – Application of this knowledge to the novel situation; specifically, in accounting for relative importance of factors leading to the development of spits.

Mark scheme

**Level 2 (4–6 marks)**

**AO1** – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change.

**AO2** – Applies knowledge and understanding to the novel situation offering clear evaluation and analysis drawn appropriately from the context provided. Connections and relationships between different aspects of study are evident with clear relevance.

**Level 1 (1–3 marks)**

**AO1** – Demonstrates basic knowledge and understanding of concepts, processes, interactions, change.

**AO2** – Applies limited knowledge and understanding to the novel situation offering only basic evaluation and analysis drawn from the context provided. Connections and relationships between different aspects of study are basic with limited relevance.

Notes for answers

**AO1**

•   Systems in physical geography: systems concepts and their application to the development of desert landscapes – inputs, outputs, energy, stores/components, flows/transfers, positive/negative feedback, dynamic equilibrium.

•   Origin and development of landforms and landscapes of coastal deposition. Beaches, simple and compound spits.

•   Estuarine mudflat/saltmarsh environments and associated landscapes; factors and processes in their development.

•   Geomorphological processes: weathering, erosion, transportation and deposition.

•   Distinctively coastal processes: marine: transportation: traction, suspension (longshore/littoral drift) and deposition;

**AO2**

•   Several factors lead to the development of spits such as the one shown in the photograph, Spurn Head spit.

•   There has to be already supply of sediment, in this case provided by the boulder clay of the Holderness coastline. Longshore drift works in conjunction with a changing direction of coastline to continue to push sediment into the Humber estuary.

•   The recurved head has been formed as a result of wave refraction.

•   The area behind the spit appears to be shallow water and some may argue that this is an inter-tidal mudflat, sheltered from the sea’s most powerful energy by the spit itself.

•   In terms of relative importance, it is more a combination of factors which come together to create this landscape, though the supply of sediment and longshore drift might feature as being most important.

Credit any other valid assessment.

Generic explanation of the formation of spits (with no attempt to apply knowledge to the resource and associated information) should be held to Level 1.

**AO1 = 2, AO2 = 4**

**[Total 6 marks]**

Examiner reports

**Q1.**

This question differentiated well. Most students clearly had some knowledge of high energy coasts. Many responses that scored less tended to provide a generic description of destructive waves. The presence of destructive waves was potentially a creditworthy element of a response, but other characteristics of high energy coasts were needed to achieve full marks.

**Q2.**

This question differentiated quite well, around two thirds of students identified B as the correct option.

**Q3.**

Many quickly established that this is a mudflat and saltmarsh area in an estuary. Those that did, readily accessed credit with some sound argument around the importance of different factors. Many argued that it is actually the vegetation being highly adapted and trapping sediment which is the most important factor. Students were free to argue their own position as long as there was a sustained line of reasoning.

**Q4.**

These AO3 questions can require students to evaluate as well as analyse data. Students can therefore be required to assess the usefulness of sources in displaying information. This is clearly distinct from analysing data and many did not read the question carefully. As a result, they scored few marks where they simply analysed data. Even where they did try to evaluate, some simple opportunities were missed. Responses could have successfully referenced the different timescales, the presence of longitude and latitude, the difference in the two keys and the curious way that the landmass was shown in **Figure a**. It would be helpful to ensure that students are given opportunity to practise these types of AO3 questions as well as those that require analysis.

**Q7.**

Just under half of students accessed this question well giving responses that reached Level 3 or better, but around a quarter also only scored in Level 1, so it did differentiate quite well. The best responses demonstrated clear detailed knowledge of a range of specific submergent and emergent features, and secure knowledge about possible factors that would affect their development in the future. Most started with the supposition that due to climate change and warming, sea levels will rise at an increasing rate in coming decades, with the best answers offering some quantitative support. Many then suggested that this global eustatic rise in sea level will indeed lead to the more rapid formation of submergent features. However, the best responses then countered this with reference to more localised areas where isostatic uplift may outpace the predicted sea level rise. Weak responses showed little understanding of the above, and often focused on erosional and depositional landforms.

**Q14.**

Students generally engaged well with this question but it also differentiated well. 58% accessed Level 3 or better with a clear focus upon the context of the question. Students were required to contrast the impact of human activity with natural processes upon coastlines. Some were a little unbalanced favouring one or the other. This was permissible if coherently argued. For human activity, many considered the role of intervention through coastal management and its unintended consequences, for instance at Hornsea on the Holderness coastline. For natural processes, many considered erosional and depositional processes and their impacts. Human induced climate change also featured and its association with sea level change. This was also a valid approach.

**Q15.**

This response produced a mean mark of 4.69 and showed that students generally engaged reasonably well with its requirements. Most showed that wind has a direct impact upon the size and power of waves. Others went further to consider fetch and the role of tides. Not many considered local factors such as the local geomorphology. Some drifted into description of low and high energy coastlines and their features. This scored little credit as it was considered to be the output of the energy and not a factor determining the impact of energy.

**Q16.**

This did cause some confusion to students. 46% correctly identified lozenge D as being correct. There is significant overlap between the definitions of wave quarrying cavitation and hydraulic action. By process of elimination students should have worked out that the other definitions linked to attrition, abrasion and solution.

**Q17.**

The mean mark was 2.0 for this question and so it proved to be accessible. Some responses drifted into the impact of these types of waves rather than their physical characteristics i.e. their typical height, wave length and frequency. This was easily achieved by comparing with destructive waves. Reference was also made to the relative power of swash and backwash.

**Q18.**

This was not a particularly successful question for many candidates. They were simply required to analyse the data. This question was testing geographical skills and not the application of knowledge and understanding. Using the resource students simply needed to analyse what was taking place within the sediment cell. There was plenty of information provided including the longshore transfer, the input from local rivers, the loss by wind the erosion and deposition areas. Relatively few students took the opportunity to make some basic calculations to help with the analysis. Instead, many tried to apply knowledge or simply lift and describe information taken directly from the resource.

**Q19.**

The resource presented lots of opportunity to analyse patterns across the world in relation to erosion and accretion at beaches. Some took a critical view of the resource itself which was a valid approach. The merging of proportional symbols was problematic in terms of identifying patterns and clusters and students correctly identified this. Not much use was made of the horizontal column of bars detailing erosion and accretion by degree of latitude. There was opportunity to identify similarity and difference in erosion and accretion but not many took this with any great precision. As so much data was potentially available for analysis, students simply had to show that they understood the basis of the resource and the patterns / clusters which it displayed as well as any anomalies. Although not a strong feature of the responses, some still found ways of demonstrating data manipulation.

**Q20.**

83% of students correctly shaded lozenge C.

**Q21.**

60% of responses reached Level 2 or better, showing most students found this question accessible. However, the mean mark was 4.23 indicating that many were not able to access the full range of marks available. Answers that did not score well often confused processes of erosion and weathering. Others showed poor AO1 knowledge of the detail of processes of weathering. Some responses could not access the higher marks as they lacked AO2 application of their knowledge and had limited assessment. The best answers had detailed assessment of the role of weathering in relation to specific coastal landforms, supported with detailed knowledge and understanding of specific weathering processes. Some assessed the role of weathering in relation to other factors, such as erosion or mass movement, as long as the role of weathering was key to the assessment this route was creditworthy.

**Q22.**

This question had a strong physical geography dimension to it. Those who understood the difference between weathering and erosion were in a strong position. Provided they could apply this to different landscapes and explain how these processes contributed to the landscape formation, they were in a strong position. A number could not distinguish between the processes. Finding credit in this situation was difficult. Place reference and detailed support was generally not strong, though case studies such as Holderness did emerge. Some students did consider the relative importance of these two distinct processes, and then considered depositional processes and the role of human intervention in coastal processes. This was credited as relevant in terms of the AO2 element of the question.

**Q23.**

86% of students correctly shaded lozenge D.

**Q25.**

This question proved challenging for many students. Although examiners looked for a ‘clear attempt’ for the arrows to be drawn with straight sides a significant number of the arrows were drawn freehand without a ruler and were not accurate enough to gain any credit. Responses that scored well then provided some clear analysis of the data presented on the map. Many of these attempted to manipulate the data and provide comparisons of the volume of littoral drift at different locations or made clear use of the map in terms of scale, distance and direction in their analysis. The least effective responses simply lifted data from the map. Some drifted into possible explanation of the littoral drift addressing AO2, application of own knowledge, for which there was no credit.

**Q26.**

This proved to be a straightforward question with almost all students correctly identifying A as the right option.

**Q28.**

Many struggled to see the link between weathering and coastal landscape development, often confusing this with erosional processes.