GEO.PH6 UK Physical Landscapes: Coastal Landscapes

AQA 8035 · Calculator allowed · about 65 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 State what is meant by each of these processes of coastal erosion.

(a) Hydraulic action **(1)**

(b) Abrasion **(1)**

(c) Attrition **(1)**

(d) Solution **(1)**

(Total for Question 1 is 4 marks)

2 This question is about weathering and mass movement on a coastline.

(a) Explain how freeze-thaw weathering breaks up rock in a cliff face. **(3)**

(b) State what is meant by mass movement, and name one type. **(2)**

(Total for Question 2 is 5 marks)

3 Explain how a headland and bay landscape forms on a coastline made of alternating bands of resistant and less resistant rock.

(Total for Question 3 is 5 marks)

---

4 Explain how a wave-cut platform forms.

(Total for Question 4 is 5 marks)

---

5 Explain how a cave, arch, stack and stump sequence forms at a headland.

(Total for Question 5 is 6 marks)

6 This question is about longshore drift and coastal deposition.

(a) Explain how longshore drift moves sediment along a coastline. **(4)**

(b) Explain how a spit forms as a result of longshore drift. **(4)**

(Total for Question 6 is 8 marks)

---

7 This question is about hard engineering strategies for managing coastal erosion.

(a) Name one hard engineering method of managing coastal erosion. **(1)**

(b) Describe how this method reduces coastal erosion. **(2)**

(c) State one disadvantage of this method. **(2)**

(Total for Question 7 is 5 marks)

8 This question is about soft engineering and managed retreat strategies for managing coastal erosion.

(a) Describe how beach nourishment works as a soft engineering method. **(2)**

(b) State what is meant by managed retreat as a coastal management strategy. **(2)**

(c) State one advantage of soft engineering methods compared with hard engineering methods. **(2)**

(Total for Question 8 is 6 marks)

---

9 The Holderness coast, in East Yorkshire, England, is one of the fastest-eroding coastlines in Europe.

(a) State the name of this coastline and the county it is in. **(2)**

(b) Suggest TWO reasons why the Holderness coast erodes so quickly. **(4)**

(Total for Question 9 is 6 marks)

10 Describe a named coastal management scheme on the Holderness coast, and evaluate how effective it has been. (For example, you could refer to the sea defences at Mappleton, East Riding of Yorkshire, built in 1991.)

(Total for Question 10 is 6 marks)

---

11 Over a 30-year period, a section of the Holderness coast is estimated to have lost about 60 metres of land through erosion.

(Total for Question 11 is 2 marks)

---

12 Explain why erosion further along the coast can increase after a hard engineering scheme, such as groynes, is built to protect one section of coastline.

(Total for Question 12 is 3 marks)

13 Use the case study of the Holderness coast (including Mappleton) that you have studied in this pack to answer this question.

'Hard engineering strategies are more effective than soft engineering and managed retreat strategies for managing coastal erosion.' Assess the extent to which you agree with this statement.

(Total for Question 13 is 8 marks)

Mark scheme · GEO.PH6 UK Physical Landscapes: Coastal Landscapes

Question 1

- (a) **B1** the force of waves hitting a cliff, compressing air into cracks and weaknesses in the rock, oe
- **(a) Answer: The force of waves hitting a cliff, compressing air into cracks and weaknesses in the rock.**
- (b) **B1** sand and rock fragments carried by waves are thrown against a cliff, wearing it away, oe
- **(b) Answer: Sand and rock fragments carried by waves are thrown against a cliff, wearing it away.**
- (c) **B1** rock fragments carried by waves collide with each other, breaking into smaller, more rounded pieces, oe
- **(c) Answer: Rock fragments carried by waves collide with each other, breaking into smaller, more rounded pieces.**
- (d) **B1** soluble minerals (e.g. from chalk or limestone) are dissolved by seawater, oe
- **(d) Answer: Soluble minerals are dissolved by seawater.**

Question 2

- (a) **B1** water enters cracks in the rock and freezes when the temperature drops below 0 degrees C, oe
- (a) **B1** as it freezes, the water expands, widening the crack, oe
- (a) **B1** repeated freezing and thawing over time widens the cracks further, until pieces of rock break off, oe
- **(a) Answer: Water enters cracks in the rock and freezes when the temperature drops below 0 degrees C; as it freezes it expands, widening the crack. Repeated freezing and thawing eventually breaks pieces of rock off.**
- (b) **B1** the movement of weathered material down a slope under the force of gravity, oe
- (b) **B1** any correctly named type, e.g. rockfall, landslide, or rotational slumping, oe
- **(b) Answer: The movement of weathered material down a slope under the force of gravity, for example rockfall.**

Question 3

- **B1** where bands of different rock type meet the sea at an angle (a discordant coastline), each rock type is eroded at a different rate, oe
- **B1** the less resistant rock is eroded more quickly by hydraulic action and abrasion, oe
- **B1** this forms an inlet, or bay, oe
- **B1** the more resistant rock is eroded more slowly, oe
- **B1** so it remains standing out into the sea as a headland, oe
- **Answer: Where alternating bands of resistant and less resistant rock meet the sea at an angle, the less resistant rock is eroded more quickly by hydraulic action and abrasion, forming an inlet (bay), while the more resistant rock is eroded more slowly and is left standing out into the sea as a headland.**

Question 4

- **B1** waves erode a notch (a wave-cut notch) into the base of a cliff, mainly through hydraulic action and abrasion, oe
- **B1** as the notch deepens, the rock above becomes unsupported, oe
- **B1** eventually the unsupported rock collapses, and the cliff retreats landward, oe
- **B1** this process repeats over time, causing the cliff to retreat further, oe
- **B1** leaving behind a gently sloping, wave-cut platform of rock at the base of the retreating cliff, oe
- **Answer: Waves erode a notch into the base of a cliff; as the notch deepens, the unsupported rock above eventually collapses and the cliff retreats landward. Repeated over time, this leaves behind a gently sloping wave-cut platform of rock at the base of the retreating cliff.**

Question 5

- **B1** waves attack a weakness, such as a crack or joint, in a headland, mainly by hydraulic action, oe
- **B1** over time this widens into a cave, oe
- **B1** if the cave is eroded all the way through the headland, it becomes an arch, oe
- **B1** continued erosion and weathering widen the base of the arch until it can no longer support the rock above and it collapses, oe
- **B1** this leaves an isolated pillar of rock, a stack, standing separate from the headland, oe
- **B1** further erosion at the base of the stack eventually causes it to collapse too, leaving a low, eroded stump, oe
- **Answer: Waves attack a weakness in a headland, mainly by hydraulic action, widening it into a cave; if eroded all the way through, it becomes an arch. Continued erosion at the base of the arch causes it to collapse, leaving an isolated stack; further erosion at the stack's base eventually causes it to collapse too, leaving a low stump.**

Question 6

- (a) **B1** waves usually approach the coast at an angle, determined by the direction of the prevailing wind, oe
- (a) **B1** the swash (the wave moving up the beach) carries sediment up the beach at this same angle, oe
- (a) **B1** the backwash (the water flowing back down the beach) is pulled straight back down the beach by gravity, at right angles to the shore, oe
- (a) **B1** this repeated zig-zag movement gradually transports sediment along the coast in the direction of the prevailing wind, oe
- **(a) Answer: Waves usually approach the coast at an angle set by the prevailing wind; the swash carries sediment up the beach at this angle, while the backwash flows straight back down under gravity. This repeated zig-zag movement gradually transports sediment along the coast.**
- (b) **B1** longshore drift transports sediment along the coast in the direction of the prevailing wind, oe
- (b) **B1** where the coastline changes direction, e.g. at a river estuary, the sediment continues to be deposited in roughly the same direction, building out from the coast rather than following the bend, oe
- (b) **B1** over time this builds a long, narrow ridge of deposited sediment extending out into the sea/estuary, oe
- (b) **B1** a change in wind direction can curve the end of the spit, forming a recurved end, and the sheltered water behind it allows fine sediment to settle, often forming a salt marsh, oe
- **(b) Answer: Longshore drift transports sediment along the coast; where the coastline changes direction, such as at a river estuary, sediment keeps being deposited in roughly the same direction rather than following the bend, gradually building a long, narrow ridge (spit) out into the sea. A change in wind direction can curve the end into a recurved shape, and the sheltered water behind often allows a salt marsh to form.**

Question 7

- (a) **B1** any valid hard engineering method, e.g. a sea wall, rock armour (rip-rap), gabions, or groynes, oe
- **(a) Answer: For example, a sea wall.**
- (b) **B1** a sea wall is a solid, curved concrete barrier built at the base of a cliff or along a beach, oe
- (b) **B1** it reflects wave energy back out to sea, preventing waves from reaching and eroding the land behind it, oe
- **(b) Answer: A sea wall is a solid, curved concrete barrier that reflects wave energy back out to sea, preventing waves from reaching and eroding the land behind it.**
- (c) **B1** any valid disadvantage, e.g. it is very expensive to build and maintain, oe
- (c) **B1** linked detail, e.g. or it looks unnatural and can spoil the appearance of a beach, or the reflected wave energy can increase erosion at the base of the wall over time, oe
- **(c) Answer: For example, sea walls are very expensive to build and maintain, and the reflected wave energy can increase erosion at the base of the wall over time.**

Question 8

- (a) **B1** sand or shingle, usually dredged from elsewhere (e.g. offshore), is added to an existing beach, oe
- (a) **B1** this builds up a wider, higher beach, which absorbs wave energy and protects the land behind it, oe
- **(a) Answer: Sand or shingle, usually dredged from elsewhere, is added to an existing beach, building it up so it absorbs wave energy and protects the land behind it.**
- (b) **B1** allowing an area of low-value land to flood or erode naturally, rather than defending it, oe
- (b) **B1** often to create a new habitat (e.g. salt marsh) that also acts as a natural buffer against future flooding/erosion further inland, oe
- **(b) Answer: Allowing an area of low-value land to flood or erode naturally rather than defending it, often to create a new habitat such as salt marsh that also acts as a natural buffer against future flooding or erosion further inland.**
- (c) **B1** any valid advantage, e.g. soft engineering is usually cheaper than building hard defences, oe
- (c) **B1** linked detail, e.g. or it works with natural coastal processes and looks more natural, with a smaller impact on the coastal ecosystem, oe
- **(c) Answer: For example, soft engineering is usually cheaper than hard engineering, and it works with natural coastal processes, with a smaller impact on the coastal ecosystem.**

Question 9

- (a) **B1** the Holderness coast
- (a) **B1** East Yorkshire (East Riding of Yorkshire), England
- **(a) Answer: The Holderness coast, in East Yorkshire (East Riding of Yorkshire), England.**
- (b) **B1** reason 1, e.g. the cliffs are made of boulder clay, a soft, easily eroded rock, oe
- (b) **B1** linked detail, e.g. boulder clay has little resistance to hydraulic action and abrasion, and also readily slumps when saturated with water, oe
- (b) **B1** reason 2, e.g. the coast is exposed to powerful waves that have travelled a long distance across the North Sea (a long fetch), oe
- (b) **B1** linked detail, e.g. giving the waves more energy to erode the soft cliffs, oe
- **(b) Answer: The cliffs are made of boulder clay, a soft rock with little resistance to erosion that also readily slumps when saturated; and the coast is exposed to powerful waves that have travelled a long distance across the North Sea (a long fetch), giving them more energy to erode the soft cliffs.**

Question 10

- **B1** names a valid coastal management scheme, e.g. the Mappleton sea defences, East Riding of Yorkshire, built 1991
- **B1** describes the scheme, e.g. rock armour (rip-rap) and two rock groynes were built to protect the village from erosion, oe
- **B1** further descriptive detail, e.g. the scheme was built after the village was at serious risk of losing homes and the coastal road to erosion, oe
- **B1** evaluates a strength, e.g. it has successfully protected Mappleton's homes and the coast road from further erosion since it was built, oe
- **B1** evaluates a limitation, e.g. by trapping sediment, the groynes have starved beaches further along the coast (e.g. to the south, such as at Cowden) of sand, leading to faster erosion there, oe
- **B1** reaches an overall judgement, e.g. supported by evidence, on how effective the scheme has been, oe
- **Answer: For example, the Mappleton sea defences (East Riding of Yorkshire, built 1991) used rock armour and two rock groynes to protect the village, after it was at serious risk of losing homes and the coast road to erosion. The scheme has successfully protected Mappleton since it was built, though by trapping sediment the groynes have starved beaches further along the coast of sand, leading to faster erosion there.**

Question 11

- **M1** 60 / 30 seen, oe
- **A1** 2 metres per year cao
- **Answer: 2 metres per year.**

Question 12

- **B1** groynes trap sediment being moved along the coast by longshore drift, building up a wider beach on the up-drift side, oe
- **B1** this means less sediment travels further along the coast to beaches down-drift, oe
- **B1** with less beach material to absorb wave energy, the down-drift coast is more exposed to erosion, an effect known as the terminal groyne effect, oe
- **Answer: Groynes trap sediment moving along the coast by longshore drift, building up the beach on the up-drift side, but this means less sediment reaches beaches further down-drift; with less material to absorb wave energy, the down-drift coast becomes more exposed to erosion, known as the terminal groyne effect.**

Question 13

- **Level 4** (7-8): A detailed, well-balanced assessment that uses accurate, detailed reference to named hard, soft and/or managed retreat strategies (and a named UK example); weighs their relative effectiveness, cost and wider impact, and reaches a clear, justified conclusion.
- **Level 3** (5-6): A clear assessment that uses accurate reference to hard and soft/managed retreat strategies; a conclusion is reached, though the balance of the argument may be less developed or use less named detail.
- **Level 2** (3-4): Some relevant points about hard and/or soft engineering are made, with limited or generalised detail; a simple conclusion is given with little justification.
- **Level 1** (1-2): One or two isolated relevant points about coastal management are made, with little or no comparison of strategies.
- **Level 0** (0): No relevant content.
- **Indicative content:**
  - Hard engineering (e.g. the Mappleton sea defences: rock armour and groynes) can provide strong, reliable protection for the specific area it defends, protecting homes, roads and other valuable property from a fast-eroding coastline.
  - Hard engineering is expensive to build and maintain, and can have negative knock-on impacts elsewhere, such as the terminal groyne effect starving beaches further down-drift of sediment and increasing erosion there, as seen along the Holderness coast beyond Mappleton.
  - Soft engineering (e.g. beach nourishment) and managed retreat are usually cheaper and work with, rather than against, natural coastal processes, and managed retreat can create valuable new habitats such as salt marsh.
  - Soft engineering and managed retreat may be less effective at protecting existing developments that are already built close to the coast, since managed retreat in particular means accepting the loss of that land rather than defending it.
  - Real coastal management, including along the Holderness coast, often combines different strategies in different sections, suggesting effectiveness depends on choosing the right approach for each specific stretch of coast rather than using one method everywhere.
  - A well-supported conclusion should state a clear judgement on which approach (or combination) is more effective overall, backed by evidence from the named Holderness/Mappleton case study.