3.9 Coastal Management and a UK Scheme

AQA 8035 · Calculator allowed · about 50 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Invented classroom cost data, not real Mappleton costs. Both options cover the same fictional frontage. Sea wall: initial cost £1,200,000 and annual maintenance £20,000. Nourishment: initial cost £240,000 and annual repeat work £80,000. Total cost = initial cost + (number of years x annual cost). Count one annual payment in each year, including year 1. Ignore inflation, discounting and all other costs.

Calculate the total cost of each option over 10 years and the difference between them.

(Total for Question 1 is 3 marks)

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2 Invented classroom cost data, not real Mappleton costs. Both options cover the same fictional frontage. Sea wall: initial cost £1,200,000 and annual maintenance £20,000. Nourishment: initial cost £240,000 and annual repeat work £80,000. Total cost = initial cost + (number of years x annual cost). Count one annual payment in each year, including year 1. Ignore inflation, discounting and all other costs.

Over 10 years, the sea wall totals £1,400,000 and nourishment totals £1,040,000. Calculate how much cheaper nourishment is as a percentage of the sea wall total. Give your answer to one decimal place.

(Total for Question 2 is 3 marks)

3 Invented classroom cost data, not real Mappleton costs. Both options cover the same fictional frontage. Sea wall: initial cost £1,200,000 and annual maintenance £20,000. Nourishment: initial cost £240,000 and annual repeat work £80,000. Total cost = initial cost + (number of years x annual cost). Count one annual payment in each year, including year 1. Ignore inflation, discounting and all other costs.

A councillor says, "Nourishment starts cheaper, so it will always cost less." Use the 20-year totals to assess this claim. Give one reason why cost alone cannot determine the best option.

(Total for Question 3 is 4 marks)

4 Repository case-study evidence: Mappleton, on the Holderness coast in East Riding of Yorkshire, England. Soft boulder clay cliffs and energetic North Sea waves make erosion a threat. In 1991, rock armour and two rock groynes were built after erosion threatened homes and the coast road. The defences protected the village and road locally. Trapping sediment reduced its supply down-drift to the south, contributing to faster erosion there. These are real case-study facts; the invented costs in Questions 1-3 do not describe this scheme.

Explain two reasons why coastal management was needed at Mappleton. Develop each reason.

(Total for Question 4 is 4 marks)

5 Repository case-study evidence: Mappleton, on the Holderness coast in East Riding of Yorkshire, England. Soft boulder clay cliffs and energetic North Sea waves make erosion a threat. In 1991, rock armour and two rock groynes were built after erosion threatened homes and the coast road. The defences protected the village and road locally. Trapping sediment reduced its supply down-drift to the south, contributing to faster erosion there. These are real case-study facts; the invented costs in Questions 1-3 do not describe this scheme.

Explain how the two rock groynes could produce both a benefit at Mappleton and a disadvantage farther south.

(Total for Question 5 is 4 marks)

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6 Fictional planning brief: a town has buildings close to the beach; a neighbouring stretch has damaged dunes and a low-lying field with no buildings. The field owner wants to keep farming. The council wants to protect buildings, conserve habitats and limit future spending.

"Hard engineering is the best choice for every part of this coast." Assess this view. Compare hard engineering with at least one of nourishment/reprofiling, dune regeneration or managed realignment, and reach a supported judgement.

(Total for Question 6 is 6 marks)

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7 Explain how a sea wall helps protect the land behind it from wave erosion.

(Total for Question 7 is 2 marks)

8 Explain how groynes can build a wider beach.

(Total for Question 8 is 2 marks)

9 Beach nourishment adds sediment to a beach. Beach reprofiling reshapes sediment already there. Distinguish these two strategies and explain one way a wider beach can protect the coast.

(Total for Question 9 is 3 marks)

10 A fictional dune project fences off damaged areas and plants marram grass. Wind-blown sand collects around the grass and its roots bind the sand. Explain how these measures help dune regeneration.

(Total for Question 10 is 3 marks)

11 For a fictional site, gabions have a lower initial price than a concrete sea wall, but the wire cages need frequent repair. The sea wall reflects waves and may suffer erosion at its base. Compare one advantage and one disadvantage of choosing gabions rather than the sea wall.

(Total for Question 11 is 4 marks)

12 On a fictional coast, longshore drift carries sand southwards. New groynes trap sand beside a northern resort. Explain why resort businesses and people living immediately south of the groynes may disagree about the scheme.

(Total for Question 12 is 4 marks)

Mark scheme · 3.9 Coastal Management and a UK Scheme

Question 1

Uses initial + 10 x annual cost for both options; allow a single arithmetic slip. **M1**

Both correct totals: sea wall £1,400,000; nourishment £1,040,000. **A1**

Difference £360,000 with nourishment correctly identified as cheaper. Accept equivalent units such as £0.36 million; allow follow-through from clearly shown totals if the subtraction and direction match them. **A1**

Answer: Sea wall: £1,200,000 + (10 x £20,000) = £1,400,000. Nourishment: £240,000 + (10 x £80,000) = £1,040,000. Nourishment costs £360,000 less over 10 years.

Question 2

Finds the difference: £1,400,000 - £1,040,000 = £360,000. **M1**

Divides the difference by the sea wall total and multiplies by 100: (360000 / 1400000) x 100. Do not use the nourishment total as the denominator for the requested saving. **M1**

25.7%, correctly interpreted as nourishment being cheaper relative to the sea wall total over 10 years. A reverse comparison of 34.6% more expensive uses a different base and is not this answer. Accept 25.7% alone as the correct answer in the question context; no written restatement of the comparison is required. **A1**

Answer: Difference = £360,000. Percentage saving = (360,000 / 1,400,000) x 100 = 25.714285...%, so nourishment is 25.7% cheaper than the sea wall over 10 years.

Question 3

Applies initial + 20 x annual cost to both options. **M1**

Correct totals of £1,600,000 for the sea wall and £1,840,000 for nourishment. **A1**

Rejects "always": at 20 years nourishment costs £240,000 more, or correctly states the wall is cheaper because nourishment has higher recurring costs. Accept follow-through if the stated conclusion follows clearly shown totals. **B1**

Explains a relevant non-cost factor, such as effectiveness against waves, effects on habitats, visitor access or stakeholder interests. Credit either option if supported; price alone does not establish suitability. **B1**

Answer: Over 20 years the wall costs £1,200,000 + £400,000 = £1,600,000, while nourishment costs £240,000 + £1,600,000 = £1,840,000. The claim is false: nourishment costs £240,000 more at 20 years because annual costs accumulate. Protection, habitat or beach access must also be considered.

Question 4

Identifies a physical reason: soft boulder clay cliffs or energetic North Sea waves. **B1**

Develops the physical reason by linking low resistance or wave energy to rapid erosion or cliff retreat. **B1**

Identifies threatened homes or the coast road as a reason for intervention. **B1**

Develops the human reason, such as preventing housing loss, displacement or disruption of transport. Accept two different well-developed reasons drawn from the evidence, including two distinct human reasons; do not require statistics not supplied. **B1**

Answer: Soft boulder clay offers little resistance to wave erosion, so the cliff retreats. Homes and the coast road were threatened, so management was needed to reduce loss of housing and preserve access along the coast.

Question 5

Groynes interrupt longshore drift and trap sediment at Mappleton. **B1**

Accumulation builds a beach that absorbs wave energy and protects the village or road. **B1**

Less sediment moves to the down-drift coast to the south, so its beach loses protection. **B1**

Linked greater wave attack or erosion risk there. Do not credit a claim that Mappleton groynes protect every part of Holderness equally. **B1**

Answer: The groynes trap sediment moving by longshore drift, building a protective beach at Mappleton that absorbs wave energy. Less sediment reaches the beach to the south, leaving it narrower and less able to absorb wave energy, increasing erosion risk there.

Question 6

Level 3 Developed, accurate reasoning weighs benefits against costs or conflicts using the supplied context. A supported judgement explains which considerations matter most. Award 6 where the reasoning is sustained and the conclusion follows convincingly from the evidence; award 5 where this is less consistent. **5-6**

Level 2 Some clear explanation applies relevant management knowledge to the context. There is some comparison or consideration of different interests, but weighing is partial or the judgement has limited support. Award 4 for clearer development and application; award 3 for a less developed response. **3-4**

Level 1 Basic relevant statements about management, with little development or application. A judgement may be asserted without support. Award 2 for more relevant detail; award 1 for an isolated relevant point. **1-2**

Level 0 No relevant content. **0**

Indicative content:

- Mark by best fit across the levels, out of 6. The B1 points below identify creditworthy content, not six compulsory ticks or extra marks. Accept any alternative supported judgement. No separate spelling, punctuation or grammar marks are awarded.
- B1: Credit an accurate hard-engineering mechanism linked to protecting buildings, such as a wall reflecting waves or rock armour dissipating energy.
- B1: Credit development of a hard-engineering cost or limitation, such as maintenance, base scour or a groyne reducing sediment supply down-drift.
- B1: Credit an accurate comparison with nourishment/reprofiling, dune regeneration or managed realignment in the supplied setting.
- B1: Credit explanation of a soft-strategy limitation, such as repeat nourishment or the need to protect regenerating vegetation from trampling.
- B1: Credit weighing of a conflict, such as farmland loss against habitat creation or access restrictions against dune protection.
- B1: Credit a supported overall judgement, including a conditional decision, a combination of strategies or a defended preference for hard engineering.
- Alternative supported judgement in favour: prioritising hard structures across this short coast could be justified if a response explains how protecting the connected town and access outweighs habitat gains, repair costs and the farmer's interests. The fictional brief gives no numerical hazard probabilities; reasoned conditions are acceptable.
- Alternative supported judgement against: prioritise dune regeneration and nourishment away from buildings, with selective hard defences at the town; justify the spatial differences. Do not assume a soft method always has the lowest lifetime cost.
- Example supported response: I disagree with using hard engineering everywhere. A sea wall or rock armour could reduce wave attack beside the town, where buildings cannot simply be moved inland. But a wall can be costly and reflected waves can erode its base. At the damaged dunes, fencing and planting can rebuild a barrier while conserving a dune habitat, although access restrictions may upset visitors. Nourishment can maintain a beach but repeat work adds costs. Moving a defence inland at the field could allow salt marsh to develop, but it would remove farmland and conflict with the owner. A combination best meets the council's aims: defend the buildings and restore dunes, while considering realignment only where land loss is acceptable. Local priorities and future maintenance should decide the final balance.

Question 7

A wall acts as a barrier between the waves and the land. **B1**

Linked explanation: it reflects wave energy seawards, reducing direct wave attack on the land. Accept a curved wall redirecting waves seawards. **B1**

Answer: A sea wall forms a barrier between waves and the land. It reflects wave energy towards the sea, reducing direct wave attack on the land behind.

Question 8

Groynes interrupt longshore drift and trap moving sediment. **B1**

Linked accumulation of sediment makes the beach wider on the up-drift side. Do not credit the claim that groynes produce new sediment. **B1**

Answer: Groynes interrupt longshore drift and trap sediment on the up-drift side. Sediment accumulates there, making the beach wider.

Question 9

Nourishment adds sediment to increase beach material. **B1**

Reprofiling redistributes existing material to change the beach shape or slope; it does not necessarily add sediment. **B1**

A wider beach dissipates wave energy before it reaches the land, reducing erosion or overtopping. **B1**

Answer: Nourishment imports and adds sediment, whereas reprofiling moves existing beach sediment to change the beach profile. A wider beach absorbs wave energy before waves reach the cliff or buildings.

Question 10

Fencing reduces trampling so plants can establish or recover. **B1**

Grass traps wind-blown sand so dunes accumulate or rebuild. **B1**

Roots bind sand, reducing erosion and helping dunes persist. Accept another linked explanation of how maintaining dunes protects land. **B1**

Answer: Fences reduce trampling, allowing vegetation to recover. Marram grass traps wind-blown sand so dunes build up. Its roots bind sand, reducing its removal and helping maintain a protective dune barrier.

Question 11

An advantage of gabions relative to this wall, such as the lower initial price given. **B1**

Development of that advantage, such as retaining funds for another section of coast. **B1**

A disadvantage relative to the wall, such as frequent wire-cage repairs. **B1**

Development, such as recurring repair costs reducing the initial saving or broken cages releasing stones and reducing protection. Accept a developed comparison of energy dissipation with reflection and base erosion instead of the cost advantage. Credit any valid equivalent comparison without assuming all gabions always cost less. **B1**

Answer: Gabions would use less of the initial budget than the wall, leaving money for other works. However, frequent cage repairs would add recurring expenditure and could reduce this saving over time.

Question 12

Businesses may support sediment accumulation and a wider beach at the resort.	**B1**
Linked benefit, such as visitor spending or reduced wave erosion of premises.	**B1**
Residents down-drift to the south may oppose sediment starvation and beach narrowing.	**B1**
Linked cost of less wave-energy dissipation and increased erosion risk to their land. Credit other supported stakeholder perspectives; no mark for simply saying people disagree.	**B1**

Answer: Resort businesses may support a wider beach because it attracts visitors and protects premises by absorbing wave energy. Residents to the south may oppose the scheme because less sand reaches their beach, reducing its protective effect and exposing their land to greater erosion.