3.7 Coastal Processes and Erosional Landforms

AQA 8035 · Calculator allowed · about 50 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Rainwater containing dissolved carbon dioxide reaches a limestone cliff. Explain how chemical weathering can widen a crack in this cliff.

(Total for Question 1 is 2 marks)

2 Two angular pebbles repeatedly collide in breaking waves. Explain how attrition changes the pebbles.

(Total for Question 2 is 2 marks)

3 Waves strike an open joint in a cliff. Explain how hydraulic power can enlarge the joint.

(Total for Question 3 is 3 marks)

4 A storm wave throws sand and small stones against the base of a cliff. Explain how abrasion can help form a notch there.

(Total for Question 4 is 3 marks)

5 Resource 3: invented cliff observations. A: blocks descend vertically from a steep, jointed face. B: a coherent slab moves down a straight bedding plane inclined towards the sea. C: a saturated mass rotates down a curved slip surface and its top tilts backwards. Name the type of mass movement at A, B and C.

(Total for Question 5 is 3 marks)

6 Resource 4: two invented cliff sections receive the same wave energy. Both are made of the same rock. Cliff X has closely spaced open joints and beds dipping towards the sea. Cliff Y has few joints and near-horizontal beds. Explain two reasons why X may retreat faster than Y.

(Total for Question 6 is 4 marks)

7 Resource 5: an invented coast initially has a straight shoreline. Alternating bands of resistant sandstone and less resistant clay meet the shore at right angles. Explain how this arrangement can develop headlands and bays.

(Total for Question 7 is 4 marks)

8 Resource 6: an invented cliff is exposed to waves at its foot around high tide. The rock below is gently sloping. Explain how repeated erosion and collapse can leave a wave-cut platform.

(Total for Question 8 is 4 marks)

9 Resource 7: an invented narrow rocky headland has an open joint extending through it. Waves reach both sides. Explain how a cave can develop into an arch under these conditions.

(Total for Question 9 is 4 marks)

10 Use the named UK coastline at Flamborough Head, which is made of chalk. Resource 8: this invented scenario describes a jointed chalk cliff there, not a field survey. Waves carrying rock fragments attack its base. Water in cracks repeatedly freezes and thaws. Detached blocks can fall from the steep face. Explain how marine erosion, weathering and mass movement can work together to cause cliff retreat and leave a wave-cut platform.

(Total for Question 10 is 6 marks)

11 Resource 9: an invented jointed chalk headland has already developed an arch. Waves carrying rock fragments reach the arch supports. Its roof is cracked and exposed to wetting and freezing. Explain how the arch could become a stack and why the stack may later disappear.

(Total for Question 11 is 6 marks)

Mark scheme · 3.7 Coastal Processes and Erosional Landforms

Question 1

Dissolved carbon dioxide forms a weak acid in rainwater. **B1**

Acid reacts with or dissolves calcium carbonate in limestone, widening the crack; accept carbonation. **B1**

Answer: Dissolved carbon dioxide makes the rainwater weakly acidic. The acid reacts with and dissolves calcium carbonate in limestone, enlarging the crack.

Question 2

Collisions between pebbles chip or break fragments off. **B1**

Remaining pebbles become smaller and/or more rounded; do not require both. **B1**

Answer: Collisions chip fragments off the pebbles. They become smaller and their sharp corners become more rounded.

Question 3

Waves force water into the joint; accept compression of trapped air. **B1**

Pressure is exerted on the walls of the joint. **B1**

Repeated pressure changes weaken or detach rock, enlarging the joint. **B1**

Answer: Waves force water into the joint and compress trapped air. This creates pressure on the joint walls. Repeated pressure changes loosen rock and widen the joint.

Question 4

Waves drive sand or stones against the cliff. **B1**

Fragments scrape, grind or strike the bedrock, wearing it away. **B1**

Repeated abrasion at the base produces or deepens a notch. **B1**

Answer: Waves drive the sand and stones against the cliff. The fragments scrape or strike the rock surface. Repeated impacts wear away the cliff base, deepening a notch.

Question 5

A: rock fall. **B1**

B: sliding; accept landslide if clearly a slide on a plane. **B1**

C: slumping or rotational slip. **B1**

Answer: A: rock fall. B: sliding. C: slumping (rotational slip).

Question 6

X has more or closely spaced open joints. **B1**

More weaknesses allow water entry and hydraulic power or weathering to detach blocks more readily. **B1**

X has bedding planes inclined towards the sea. **B1**

These can provide planes for sliding or detachment, promoting retreat. Accept other valid linked structural explanations. **B1**

Answer: X has more open joints, so water and compressed air can enter more weaknesses and detach blocks. Beds dipping towards the sea provide inclined planes along which loosened slabs can slide, making collapse and retreat more likely.

Question 7

Less resistant clay is eroded faster. **B1**

Faster retreat of clay sections forms bays. **B1**

Resistant sandstone is eroded more slowly. **B1**

Sandstone remains projecting as headlands, linking the contrast in erosion to the resulting shape. **B1**

Answer: The clay erodes faster than the sandstone. Clay sections retreat inland, creating bays. The sandstone erodes more slowly and remains projecting seawards as headlands. The contrasting retreat rates produce the irregular shoreline.

Question 8

Erosion at the cliff foot forms or deepens a notch; accept hydraulic power or abrasion as the named process. **B1**

The overhang becomes unsupported and collapses. **B1**

Repeated erosion and collapse cause cliff retreat. **B1**

Retreat leaves a gently sloping rock surface at the former base, a wave-cut platform. **B1**

Answer: Hydraulic power and abrasion erode the cliff foot, making a notch. As the notch deepens, an unsupported overhang develops and collapses. Repeated undercutting and collapse move the cliff inland. The former cliff base remains as a gently sloping rock platform, often exposed at low tide.

Question 9

Hydraulic power acts on the joint, loosening rock. **B1**

Abrasion or continued erosion enlarges the opening into a cave. **B1**

Continued erosion cuts through the headland; accept two caves meeting. **B1**

A through-opening with a remaining rock roof forms an arch. Accept a coherent equivalent sequence. **B1**

Answer: Waves force water and air into the joint, increasing pressure and loosening rock. Abrasion by wave-driven fragments helps enlarge the opening into a cave. Continued erosion extends the cave through the narrow headland, or caves on opposite sides meet. This leaves an opening beneath a roof of rock: an arch.

Question 10

Link hydraulic power or abrasion to erosion of the chalk cliff foot at Flamborough Head.	**B1**
Explain that a notch deepens and an unsupported overhang develops.	**B1**
Explain freeze-thaw: water freezes and expands in cracks and repeated cycles weaken or loosen rock.	**B1**
Explain rock fall: weakened or unsupported blocks fall under gravity.	**B1**
Link repeated undercutting and collapse to inland cliff retreat.	**B1**
Explain that retreat leaves the former cliff base as a gently sloping rock platform. Credit equivalent linked explanations matching the supplied conditions, one mark per point.	**B1**

Answer: At Flamborough Head, hydraulic power forces water and air into weaknesses and abrasion wears away the chalk at the foot, forming a notch. Deepening of the notch leaves an overhang. Water freezes and expands in cracks, and repeated freeze-thaw loosens blocks. The weakened, unsupported rock falls under gravity. Repeated undercutting and falls make the cliff retreat inland. A gently sloping rock surface remains at the former cliff base as a wave-cut platform.

Question 11

Link hydraulic power or abrasion to erosion of arch supports or enlargement of the opening.	**B1**
Explain freeze-thaw expansion in roof cracks, weakening the roof.	**B1**
Link loss of support or weakening to roof collapse under gravity.	**B1**
Identify the isolated pillar left beyond the gap as a stack.	**B1**
Explain continued undercutting or weathering of the stack, causing collapse into a stump.	**B1**
Link further erosion of the stump to eventual removal. Accept equivalent causal sequences consistent with the conditions, one mark per point.	**B1**

Answer: Hydraulic power and abrasion erode the arch supports and enlarge the opening. Water freezes and expands in roof cracks, weakening the roof through repeated cycles. Loss of support and weakening allow the roof to collapse under gravity. An isolated pillar beyond the gap remains as a stack. Waves continue to erode the stack base, while weathering weakens it. Collapse reduces it to a low stump, which further erosion can eventually remove.