Answers

Test 1 – Natural Systems

1. 3 marks
Open systems (1 mark – mandatory) – there are many inputs of energy and material (1 mark). Processes and transport lead to outputs (1 mark).

Also award credit for examples of inputs, outputs and components.

2. 2 marks
A system where inputs and outputs (1 mark) are equal (1 mark).

3. 4 marks
This question is worth four marks.
Give credit for positive and negative feedback cycles.
Discussion will include erosion and deposition – e.g. erosion of a beach during an intense storm, or deposition due to dune creation.

4. 3 marks
One mark will be awarded for each two correct answers.
1. Landscape of erosion
2. Waves and winds (i)
3. Wave energy is dissipated (o)
4. Landscape of deposition (c)
5. Removal of material outside of a sediment cell (o)
6. Sea level change (i)

5. 4 marks
The sun (1 mark) – differential heating of the Earth's surface creates wind (1 mark). Wind, blowing across the ocean forms waves (1 mark). Waves provide energy for erosion to occur (1 mark).

Allow other discussions – e.g. other sources of energy – e.g. currents and tide. The student may miss the first step (the Sun), but do not penalise this.

6a. 3 marks
Allow three points:
- Waves are powerful and erosive.
- The beach is likely to be eroded (e.g. material transported out to sea).
- The beach profile is also likely to change – e.g. a storm beach may develop.
- Any other valid point(s).

6b. 3 marks
Allow three points:
- Material deposited out at sea will absorb wave energy.
- The wave energy reaching the beach is reduced.
- Therefore deposition is more likely to occur.
- Any other valid point(s).

7. 3 marks
Allow one mark per two correct labels.
N.b. high and low water marks have been added for reference, to assist with labelling.

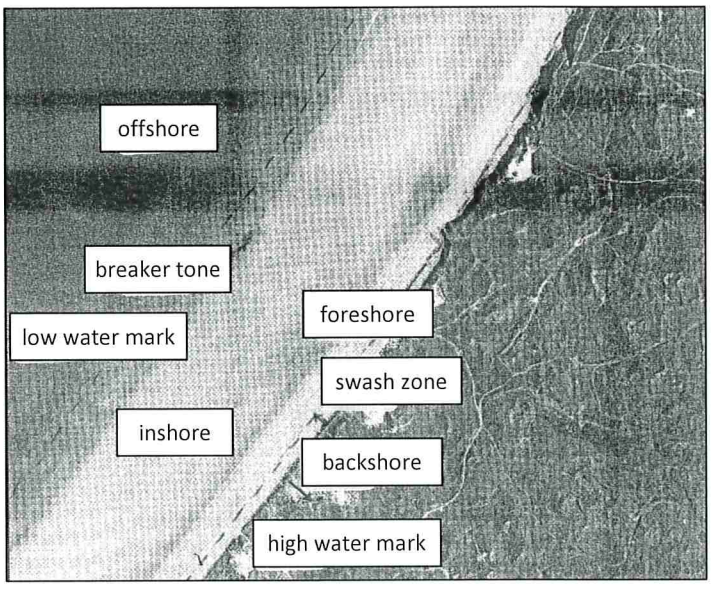

Image courtesy of Google Earth
© 2016 Google
Image © 2016 DigitalGlobe © 2016 Infoterra Ltd & Bluesky

8. 6 marks
Allow **two** marks per concept:
- **Weathering** – in situ destruction of rock [1], later eroded by weathering [1].
- **Erosion** – movement of weathered material away from the source [1], via a process such as waves and currents, wind or rivers [any one].
- **Mass movement** – land-based movement [1], downhill because of gravity [1 mark].

9. 3 marks
Fetch controls the energy of waves (1 mark). The fetch is the distance that wind travels across the open sea (1 mark), and is affected by the coastline – i.e. barriers (1 mark).

10. 7 marks
Allow one mark for each pair of points mentioned.

	Constructive	Destructive
Frequency	Less than 8 per minute	More than 10 per minute
Height	Low	High
Wavelength	Long	Short
Description	Spill	Plunge
Swash	Quickly dissipated into the beach material	Stopped by the backwash from the previous wave
Backwash	Gentle	Strong
Occur	Day to day	During storms

Extension Questions (A Level)

11. 4 marks
Allow one mark each (total of four):
1. Wind blows across the surface.
2. This causes drag (due to friction).
3. Crests and troughs develop as water moves forwards.
4. Waves grow in height near the coast where water is shallow.
5. Friction from the sea bed slows the bottom of the wave.
6. The wave breaks as the top of the wave, not slowed by friction, overtakes the bottom.

12. 6 marks
Allow a reasoned discussion, which includes a selection of the following. This question is worth six points:
- Formation of waves.
- Discussion of prevailing wind.
- Discussion of erosional and depositional features (both by the sea and aeolian processes, e.g. abrasion).
- Wind direction affects the shape and features of spits.
- Sand erosion and dune formation.

Total: 52 marks

Extension Question (AS Level)

12. 9 marks
Allow a reasoned discussion relating to wind and other coastal processes, culminating in a judgment on the relative importance of wind vs. other factors such as waves, site of the beach, geology, currents, sediment supply, forms of erosion and sub-aerial processes, mass movement, and tides, etc., which includes a selection of the following.
- Formation of waves and discussion of types and power of waves.
- Discussion of prevailing wind.
- Discussion of erosional and depositional features (both by the sea and aeolian processes, e.g. abrasion).
- Wind direction affects the shape and features of spits.
- Sand erosion and dune formation.

Total: 53 marks

Test 2 – Coastal Processes

1. 2 marks
Allow one mark each:
- Water shallows.
- The bottom of the wave is slowed down by friction on the sea bed.

2a. 2 marks
Macrotidal (1 mark) because the range is **greater than 4 metres** (1 mark).

2b. 1 mark
Microtidal

3. 8 marks
Nb. The answers given shouldn't be limited to those in the table above.

	Photograph A	**Photograph B**
Low or High Energy	High	Low
Reason 1	Erosional features (e.g. arch and stack)	Wide beach
Reason 2	White water; large waves	Deposition of material (e.g. the bar-type feature)
Reason 3	The succession of features shows the erosion has taken place for a significant time	Calm sea; small waves

4. 2 marks
They are essentially closed systems (1 mark), however some finer sediment is transferred between cells.

5. 4 marks
The retreat or advance of the coastline (1 mark) based on the differences (1 mark) in the material eroded or deposited (1 mark), for example, calculated for a sediment cell (1 mark).

6. 8 marks
Allow a discussion of four types of erosion directly associated with the marine interface, rather than sub-aerial weathering. Allow one mark for the name, and one mark for a description of each:

E.g. Solution – dissolving within the ocean water.
- **Abrasion** (aka corrasion) – material, hurled by waves, chip away at the cliffs.
- **Hydraulic action** – waves force air into cracks, exerting pressure.
- **Attrition** – swirled material wears away into smaller pieces – this is why pebbles are rounded.

7. 4 marks
A. Solution
B. Suspension
C. Saltation
D. Traction

8. 4 marks
Allow four marks for a discussion of one form of sub-aerial weathering.
- For example the student may discuss a form of chemical weathering such as carbonation (caused by acidic water), hydration (addition of water and expansion), oxidation (addition of oxygen), and hydrolysis (creation of clays).
- Allow discussion of mechanical weathering such as pressure release, heating and cooling cycles and freeze-thaw.
- Also allow a discussion of biological weathering – acids released by living organisms, burrowing creatures and birds, and plant roots.

9. 4 marks
Allow a comparison of different types – 1 mark for the name, and one mark for suitable timescale(s):
- rockfalls – seconds.
- some flows and slumps can take place over days or weeks (but dependent on the slope, may be quicker on steep slopes and ample lubrication).
- soil creep – occurs over years and decades.

10. 4 marks
Allow any four points:
- Provides a source of water for increased mass movement events.
- Can form a notch through the cliff (eroded material).
- Acts as a source of sediment from the land, adding material to the marine environment.
- There may be a seasonal element – e.g. strong winter flow.
- Any other valid point(s).

Extension Questions (A Level)

11. 6 marks
Allow any six points:
- The Moon is the main factor in tidal development (1 mark) because the Sun is too far away from the Earth to have a large influence (1 mark).
- Gravitational force.
- Water pulled towards the moon (bulge, high tide).
- High tide occurs at the opposite side, with low tide at 90°.
- Neap tides occur when the Moon is at 90° to the Sun.
- Soaring tides occur when the Sun and Moon are aligned (new moon), or at opposite sides (full moon).

12. 4 marks
One mark each (4 marks total):
- The structures are called groynes.
- Groynes trap sediment affected by longshore drift.
- Therefore material builds, stopping the beach from becoming eroded.
- However, there is less sediment downstream, which increases downstream erosion.

Total: 53 marks

Extension Questions (AS Level)

11. 6 marks
Allow any six points:
- The Moon is the main factor in tidal development (1 mark) because the Sun is too far away from the Earth to have a large influence (1 mark).
- Gravitational force.
- Water pulled towards the moon (bulge, high tide).
- High tide occurs at the opposite side, with low tide at 90°.
- Neap tides occur when the Moon is at 90° to the Sun.
- Soaring tides occur when the Sun and Moon are aligned (new moon), or at opposite sides (full moon).

12. 3 marks
Allow any three points:
- Material is in constant movement downstream (1 mark).
- Beaches are eroded (1 mark).
- Depositional features, such as spits and bars can form (1 mark), for example, where the coastline changes direction (1 mark).
- Any other valid point(s).

Total: 52 marks

Test 3 – Coastal Landscapes 1

1. 1 mark
   Wave-cut platform

2. 4 marks
   Allow four points:
   Discordant (1 mark, mandatory), and any other three points such as:
   - Alternating layers of hard and soft rock have allowed for differential erosion.
   - These layers are at 90° to the coast.
   - This is shown by the headland and bay formation.
   - The headlands form the harder bands of rock (and the eroded bays the softer bands).
   - The stacks also represent bands of hard rock.
   - Any other valid point(s).

3. 6 marks
   Allow six marks for the following order:
   1. Headland
   2. Geo (crack)
   3. Cave (either opposite sides of the headland, or makes it through)
   4. Arch
   5. Stack
   6. Stump

4. 15 marks

Image	Name of Beach Feature (1 mark)	Formation of Beach Feature (1 mark)	Location on the beach (1 mark)
A	Berm	Ridges created by constructive waves, at the high tide mark. A series form because of lowering high tides due to a reducing cycle (allow any point).	At the high tide mark, below the storm beach. Accept upper beach.
B	Ripples and Runnel	Ripples – tides and currents move the sand. Runnels form due to tides.	Low tide, accept foreshore or lower beach for both features.
C	Storm beach	Boulders are hurled to the back of the beach during storms.	The back of the beach (not usually affected by tides). Accept backshore.
D	Cusps	Powerful backwash removes material.	The upper beach/boundary or at the boundary between fine and coarse grained material.

5. 2 marks
   Simple spits are straight or have a kink (1 mark). Compound spits also have secondary spits trailing off (1 mark) (representing a succession of spits).

6. 3 marks
   Allow any three marks:
   A bar is an offshore ridge of sand (1 mark) caused by a spit which grows along a bay (due to longshore drift) (1 mark), which connects the two headlands (1 mark). There may be little offshore water (1 mark), or onshore winds (1 mark), or sometimes, material is deposited from the land (1 mark).

7. 6 marks
   - The feature is called a **barrier beach** (1 mark, mandatory).

   Allow any other five points:
   - Ridges of sand are formed by waves moving material towards the shore (1 mark).
   - The ridges form in front of the beach (1 mark), and may not submerge during high tide (1 mark).
   - Waves therefore break offshore (1 mark), protecting the coastline from the effects of the waves (1 mark).
   - Dispositional features are also likely to build up behind the beach (1 mark), such as salt marshes, sand dunes and swamps, due to the slack water (1 mark).

Extension Questions (A Level)

8. 6 marks

Allow a discussion of the following:

- Concordant vs. discordant coastline.
- Rock type and structure, differential erosion.
- Rock dip.
- Permeability and the effects on the mass movement.
- Any other valid point(s).

9. 6 marks

Allow a discussion of the following:

- Deposition: salt marshes – build-up of mud and silt; dunes – accumulation of wind-blown sand at the back of the beach.
- Causes of deposition (e.g. obstacles, roots, etc.).
- Sources of material (e.g. estuarine mud, beach sand, etc.).
- Development of a halosere and psammosere.
- Succession of ecosystems.
- Previous ecosystem builds on the next – i.e. provides stabilisation for new species.
- Fixing of an ecosystem and conversion to dry land.
- Any other valid point(s).

Total: 48 marks

Extension Questions (AS Level)

8. 6 marks

Allow a general discussion, with a viewpoint, including, but not limited to:

- Climate change.
- Glacial and interglacial periods.
- Shifts in weather patterns and storminess (changing deposition and erosion).
- Sea level change (due to melting land ice and thermal expansion).
- Isostatic rebound.
- Human activity and commercial activities.
- Human involvement, such as protection from erosion – hard and soft engineering.

9. 6 marks

Allow a discussion of the following:

- Both are vitally important.
- Deposition: salt marshes – build-up of mud and silt; dunes – accumulation of wind-blows sand at the back of the beach, and
- Causes of deposition (e.g. obstacles, roots, etc.).
- Sources of material (e.g. estuarine mud, beach sand, etc.).
- Development of a halosere and psammosere.
- Succession of ecosystems.
- Previous ecosystem builds on the next – i.e. provides stabilisation for new species.
- Fixing of an ecosystem and conversion to dry land.
- Any other valid point(s).

Total: 48 marks

Test 4 – Coastal Landscapes 2

1. 4 marks
   - **Isostatic** – local change (1 mark) due to change in the land surface level (1 mark).
   - **Eustatic** – global change (1 mark) due to sea level change (1 mark).

2a. 3 marks
Allow any three marks:
- During the ice age, sea level was lower than present (by approx. 125 metres).
- After the ice age ended, sea levels gradually rose to near current levels.
- Between 15,000 and 10,000 years ago, there were two plateaus where sea level remained almost constant for 1,000 years each.
- Sea level has remained fairly constant (slight rise) for the past 8,000 years.

2b. 2 marks
Allow any two marks:
- During ice ages, water from the oceans is locked up on the land.
- As the climate warms, the ice melts and water returns to the sea.
- By 8,000 years ago, the main ice sheets had melted, except those at high latitude and altitude.
- Any other valid point(s).

2c. 2 marks
Due to the weight of ice pushing down on the land (1 mark), the land is depressed into the mantle (1 mark).

2d. 2 marks
The sea around the UK is very shallow (especially the English Channel) (1 mark), meaning that when the sea levels dropped, new land was exposed (1 mark).

2e. 3 marks
Allow any emergent feature (e.g. **raised beach**, **relict cliffs**) (NOT rias and fjords as these are submergent features).
Allow two other marks:
- Post-glacial rebound (isostatic change).
- Increase in land-level faster than rise in sea level.

3. 2 marks
Recent increase is due to the melting of remaining glaciers, and also due to thermal expansion of water (1 mark each).

4. 4 marks
Allow any four points:
- Shifting plates and earthquakes can increase the height of the land (localised).
- The opposite can also be true, for example where a plate moves downwards into the mantle.
- Volcanic activity can also raise the land surface as new rock, lava and ash increases the surface height.
- The sea floor can also be altered by plate movement, for example lowering of the sea floor increases volume.
- The opposite is true if ocean levels rise, causing a displacement due to decreased basin volume.

5a. 4 marks
Ria (1 mark).
Allow any other three marks:
- Rias are flooded river valleys.
- Rias have a dendritic (branching) shape.
- The photograph clearly shows flooded, branching river valleys, rather than glacial troughs.
- Any other valid point(s).

5b. 4 marks
Two marks each:
Ria:
- Wide
- Shallow

Fjord:
- Narrow
- Deep

5c. 2 marks
Submerged valleys run in the same direction as the coastline (1 mark), leaving a series of islands (1 mark).

6. 6 marks
Allow any six points.
- Human development and therefore CO_2 concentrations are not certain.
- Uncertainty over the volume of land-ice to melt; harder to estimate for larger ice sheets.
- Tipping points.
- Positive feedback loops.
- Lubrication of ice sheets – large sections may slide into the sea.
- Difficult to estimate the effects of thermal expansion.
- Wide range of predictions (but averaged, they are fairly even).
- Uncertainty is increased the further into the future.
- Human intervention and activities are difficult to predict.
- Any other valid point(s).

Extension Questions (A Level)

7. 6 marks
Allow a viewpoint, and a discussion of one ecosystem development.
- The key point is that each stage provides more favourable conditions for the next stage to take place.
- Therefore the role of stages are instrumental in the development of the feature.
- For example, the roots from one stage trap sediment, allowing for conditions and soil to allow for larger plants.
- The larger the plants, the easier it becomes to trap material.
- The student should illustrate the process using one of the examples suggested above.

8. 4 marks
Allow any two points, and any two examples:
- Relict features are no longer affected by the sea – they are above the current influence (instead they are affected by subaerial rather than marine processes).
- Form as a result of sea/land level changes.
- Result if land uplift is faster than sea level rise (postglacial rebound).
- Examples include: fossil cliffs, raised beaches, marine platforms and associated features such as caves, arches and other features of erosion.
- Any other valid points and features.

Total: 50 marks

Extension Question (AS Level)

7. 9 marks
A viewpoint must be provided, supported by a relevant, balanced discussion.
Suggested content includes:
- Coastal landscapes are not created overnight.
- However, they are in a constant state of flux.
- Timescales of events – many slow, some rapid.
- Discussion of local geology – e.g. softer, unconsolidated material such as boulder clay erodes quickly – allowing for several meters of erosion per year.
- Discussion of landform development and processes (formation of a stack).
- Cliff retreat to form a wave-cut platform.
- Discussion of depositional features.
- The role of tides and currents.
- Storm events – the everyday slow processes vs. the rapid events during extreme weather.
- Timescales of mass movement events.
- Any other valid discussion topics.

Total: 49 marks

Test 5 – Coastal Management

1. 4 marks
Allow one mark for each distinguishing feature, and one mark for each example (four marks in total).
   - Hard engineering uses artificial modification of the coastline (built strictures). Examples include sea walls, rock armour (rip-rap), gabions, revetments, groynes, off-shore breakwaters, barrages and cliff stabilisation, etc.
   - Soft engineering enhances natural protection. For example, beaches are nourished using sand dredged from off-shore, planted marram grass helps to build up protective dunes, or employ (sustainable) management techniques.

2. 8 marks
Allow any two marks per example (total of eight marks).
   - **Do nothing** – allow (relatively cheap) land to be lost to the sea because defences are expensive. The material from the eroded land helps to protect the coast downstream.
   - **Managed realignment (retreat the line)** – buildings and structures are re-built further from the coast so that they will not be lost to the sea.
   - **Hold the line** – important areas such as large settlements are protected by, in many cases, Victorian hard engineering. These are maintained to protect the land, and in some cases, new structures may be built.
   - **Move seaward (advance the line)** – Defences are built in front of existing ones, to increase the area of land protected.

3. 4 marks
Allow a discussion of how humans can manage and work with nature using soft engineering techniques:
Allow any four points:
   - Soft engineering uses natural materials and processes (two marks).
   - Valuable and sometimes endangered habitats are created (e.g. dunes and marshes).
   - Management can be holistic, addressing issues over a wide area – not just for a small stretch of the coast.
   - Any other valid point(s).

4. 4 marks
Allow a discussion of the following points (four in total):
   - Comparison of costs – e.g. sea walls are very expensive.
   - The maintenance costs of different forms of hard engineering.
   - Soft engineering schemes, such as beach nourishment, may need to be periodically renewed.
   - Land varies in importance and value.
   - While important in feeding the nation, farmland may be seen as less valuable than settlements.
   - However, large settlements are likely to have more spent on protection than small villages, especially in areas where coastal retreat is rapid.
   - Any other valid point(s).

5a. 1 mark
Each SMP covers a whole, or part of a sediment cell, of which there are eleven sediment cells.

5b. 4 marks
Allow any four points:
   - Cover a large area – holistic.
   - Plan for three timescales (short to long term).
   - Long scale plans – 100 years, and allow for change.
   - Account for habitats and biodiversity.
   - Any other valid point(s).

6. 6 marks
Allow six points:
   - Ecosystem approach.
   - Holistic approach.
   - A result of the 1992 UN Earth Summit.
   - Applicable to Europe.
   - Covers both the sea and coastal land too.
   - Works with nature.
   - Involves a wide range of players (stakeholders).
   - Encompasses the natural environment and users of the coastal zone.
   - Focuses on sustainability.
   - Long-term goals.
   - Updated as appropriate.
   - Can be adapted to meet local needs.
   - Aims to ensure that habits are protected from destruction and pollution.
   - Any other valid point(s).

7. 1 mark
Maritime Spatial Planning (MSP)

8. 8 marks
Allow any named, relevant example. Also allow credit for discussion of a former management technique used to stop erosion which resulted in side-effects, but modern, holistic management has resulted in a direct improvement / increase in sustainability.

Suggested discussion points include:
- The effects of erosion on the morphology of the coastline.
- Impact on human activity in the region.
- The effects on habitats in the region.
- Description of the management / hard and soft engineering schemes used.
- Evaluation of the effectiveness of the schemes.
- Critical judgment on the sustainability of the schemes.

Extension Questions (A Level)

9. 4 marks
Allow discussion of the following points:
- Hard engineering schemes are often said to work against nature, and disrupt habits; therefore benefitting humans more than wildlife. However, some people may find hard engineering projects as visually intrusive.
- On the other hand, soft engineering schemes protect the land for human benefit, but can also provide valuable habitat.
- Of course, all coastal management is for human benefit, but modern approaches do not take the environment into account in a much greater way than in the past.

10. 6 marks
Allow a discussion and viewpoint, however, the student is likely to agree that ICZM is beneficial to older forms of management due to the following:
- Sustainable approach.
- Considers stakeholders and the environment.
- Large scale.
- Includes inland too – not just the sea.
- Long timescales.
- Kept relevant and up to date.
- Any other valid point(s).

Total: 50 marks

Extension Question (AS Level)

9. 9 marks
This question is worth nine marks.
Allow a discussion and viewpoint, however, the student is likely to agree that ICZM is beneficial to older forms of management due to the following:
- Considers stakeholders and the environment.
- Works with nature, rather than against.
- Large scale.
- Includes inland too – not just the sea.
- Long timescales.
- Kept relevant and up to date.
- Any other valid point(s).

Total: 49 marks

Test 6 – General and Case Studies

1. 2 marks
   Allow one mark for each two correct answers.
   - From inland – via rivers.
   - From offshore, via currents.
   - From the cliffs.
   - Attrition of rocks in the coastal zone.
   - Decomposed shells.
   - From upstream sources (via longshore drift).
   - Any other valid source(s).

2. 4 marks
   Allow four points; **two** relating to the causes, and **two** relating to the nature of storm surges.
   Causes:
   - Winter storms.
   - Coincide with high astronomical tides (e.g. spring tides at high tide).
   - Shallowing and funnelling effect of a channel (e.g. the East coast on the UK).
   - Hurricanes / tropical revolving storms (raise sea level).
   - Any other valid cause(s).

   Nature:
   - Inundate land adjacent to the sea with sea water.
   - Can travel inland for a considerable distance.
   - Can cause significant damage to the coast (and coastal defences).
   - Nowadays, storm surges can be predicted, but in the past they would be unexpected and cause more deaths.
   - Any other valid point(s).

3. 4 marks
   Allow four points:
   - The cliffs are made of alternating layers of rock.
   - Some layers are harder than others.
   - The hard layers resist erosion.
   - However, the hard layers fall away when they become undermined by the removal of the softer layer below.
   - A wave-cut platform can be seen from one of the harder layers of rock.
   - Any other valid point(s).

4. 2 marks
   One mark each:
   - **Oxidation** – metals within the rock combine with oxygen (dissolved in water).
   - **Hydrolysis** – slightly acidic water reacts with the rock to form dissolvable salts, and clay.

5. 4 marks
   The statement is valid (1 mark).
   Allow three further marks:
   - Eustatic change is the global change in sea level (1 mark), such as ice age changes in sea level, and melting land ice (1 mark each).
   - Isostatic change is local and caused factors such as post-glacial rebound of the land surface and tectonic activity (1 mark each).

6. 6 marks
   Allow six points:
   - During ice ages, sea level is lower due to ice on the land.
   - During the interglacial period, water returns to the sea and water levels rise.
   - Erosion of river valleys and glacial troughs occur when the sea levels are lower.
   - Parts of the ocean floor become land – for example, England was once joined to France.
   - These flood once more, resulting in rias and fjords.
   - The weight of ice on the land surface depresses the land surface into the mantle.
   - Once the ice melts, the land surface rises once more.
   - This leaves behind relict features.
   - Allow reference to features such as raised beaches and cliffs.
   - Successions of ice ages may result in a series of relict features such as cliffs.
   - Any other valid point(s).

7. 6 marks
Allow **two** causes and any other **four** points.
Causes:
- Melting of land ice – e.g. Antarctica, Greenland, Alpine glaciers, etc. (NOT sea ice).
- Thermal expansion of water.

Discussion points:
- Low-lying coastal areas flooded (especially countries such as Bangladesh).
- Loss of wetland habitats, for example, mangrove swamps and everglades.
- Coastline morphology changes.
- Some islands, such as the Maldives, are likely to be flooded.
- Increased erosion.
- Storm surges may become more commonplace.
- Aquifers are likely to be polluted with salt water.
- Any other valid point(s).

8. 4 marks
Allow two points each:
Traditional management – tended to focus on hard engineering (1 mark), with less regard for the environment (1 mark). May have been small-scale piecemeal approach (i.e. a sea wall in front of a settlement (1 mark), with little thought of the down-stream consequences (1 mark)).

Modern management – sustainable approach (1 mark), may be focused on management and soft engineering (1 mark), encompassing a large area of coastline (1 mark), including many stakeholders and wildlife (holistic approach) (1 mark).

9. 4 marks
Allow any four points, or two explained points:
- The area is heavily populated – there are likely to be millions of people living in the city (1 mark). Coastal flooding or erosion would affect many people (1 mark).
- The city is only metres above sea level (1 mark), meaning that sea level rising could be catastrophic (1 mark).
- The buildings on the right are exposed to the open sea (1 mark), increasing the risk of flooding of the ground floors in the event of a storm surge (1 mark).
- Hold the line policy will almost certainly be used in this example (1 mark).
- There appear to be few route ways from the city in the event of a disaster (1 mark). Ample forewarning and evacuation procedures will be necessary to ensure the safety of the cities' citizens (1 mark).
- Any other valid point(s).

Extension Question (AS and A Level)

10. 20 marks
The student will need to form a viewpoint, supported with a supporting argument. Any relevant examples may be used. There is scope to appraise the success of the coastal management in the examples provided.

Indicative content:
- Examples of effective coastal management.
- Examples from contrasting areas of the world.
- Discussion of hard and soft coastal engineering, and management techniques (e.g. ICZM, shoreline management plans).
- Examples of cities and settlements built on the coastal zone.
- Examples of failure of coastal defences and disasters.
- Costs and benefits of engineering schemes.
- Knowing whether to give up – 'do nothing' or 'managed retreat'.
- Need to replenish soft engineering schemes and repair hard engineering structures due to continued erosion from the sea.
- Tsunami still cause significant damage, even with coastal protection.
- Building of tsunami-resistant structures and shelters.

Total: 56 marks

