



CANDIDATE
NAME

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CENTRE
NUMBER

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CANDIDATE
NUMBER

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9693/13

May/June 2022

1 hour 45 minutes

You must answer on the question paper.

No additional materials are needed.

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages.

Section A

Answer **all** questions in this section.

- 1 (a) (i) The list shows five substances that are important in the marine environment.

calcium carbonate carbon dioxide glucose oxygen sodium chloride

Each substance is formed using ionic or covalent bonds.

Complete Table 1.1 to show the type of bond in each substance.

Table 1.1

ionic bonds	covalent bonds

[2]

- (ii) Water is a covalent molecule with hydrogen bonding between molecules.

Explain how hydrogen bonds are formed.

.....

.....

.....

.....

.....

.....

.....

..... [4]

- (iii) Explain the role of hydrogen bonding in the dissolution of sodium chloride in water.

.....

.....

.....

.....

..... [3]

- (b) (i) State **two** elements that are found in all carbohydrates, lipids and proteins.

..... and [1]

- (ii) Draw lines from each large molecule to the smaller molecule(s) from which it is made.

There may be **more than one** line to or from each box.

large molecule

cellulose

lipids

protein

starch

smaller molecule

amino acids

glucose

glycerol

fatty acids

[4]

- (iii) Outline how sea grasses make carbohydrates.

.....

 [3]

[Total: 17]

- 2 (a) Fig. 2.1 is a map of the world, showing the oceans.

Label the Atlantic Ocean and the Indian Ocean on Fig. 2.1.

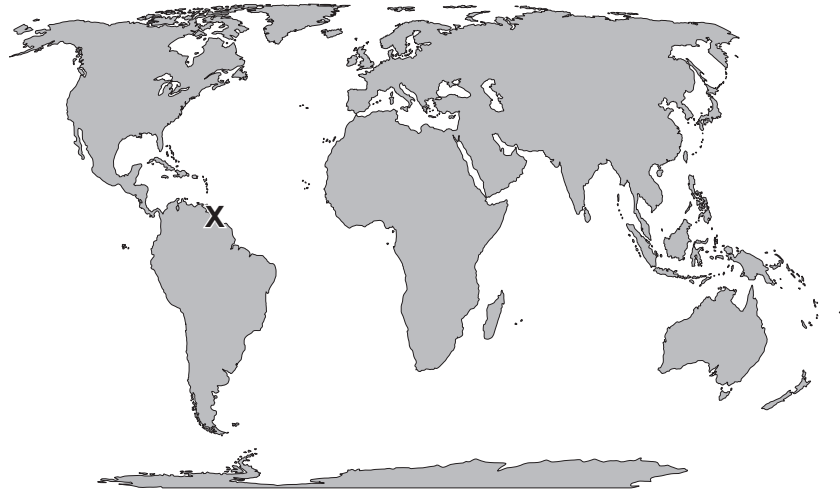


Fig. 2.1

[1]

- (b) There is a spring high tide at **X** on Fig. 2.1.

- (i) Explain how the spring high tide at **X** is formed.

.....

.....

.....

.....

.....

.....

.....

..... [4]

- (ii) The air pressure at **X** increases between a high tide and the next low tide.

State **and** explain the difference between the predicted and the actual height of the low tide at **X**.

.....

.....

.....

..... [2]

[Total: 7]

- 3 A symbiotic relationship has recently been discovered between a photosynthetic marine alga and a bacterium that only lives within the alga.

The bacteria use 20% of their own energy production to make a toxin. The toxin is not harmful to the alga but is toxic to organisms eating the alga.

- (a) (i) Suggest the type of symbiotic relationship between the alga and the bacterium.

..... [1]

- (ii) Suggest **and** explain the effect of this relationship on the alga **and** the bacterium.

.....

 [4]

- (b) One of the toxins produced by the bacterium is being investigated as a potential anti-cancer drug.

State the name of **one** other medical product that has been sourced from a marine organism.

.....
 [1]

[Total: 6]

- 4 As the tide goes out on a rocky shore, rockpools form where the sea water does not drain away.

A scientist monitors the water temperature in several rockpools in the littoral zone over a tidal cycle.

The rockpools are located at different heights above low tide level.

Table 4.1 shows the mean temperatures of the rockpools in each region of the shore.

Table 4.1

area of littoral zone	mean temperature/°C
lower shore	15.9
middle shore	16.6
upper shore	17.2

- (a) Explain why the mean temperature of the rockpools increases with height above low tide level.

.....

.....

.....

..... [2]

- (b) Describe how **and** explain why the oxygen concentrations will differ between rockpools in the different regions of the shore.

.....

.....

.....

.....

.....

..... [3]

(c) State **two** biotic factors that also affect the distribution of organisms in the lower rockpools.

1

2 [2]

(d) Suggest **two** adaptations that rocky shore organisms have to high wave action.

1

.....

2

..... [2]

[Total: 9]

- 5 Fertilisers used to grow crops in fields contain the elements nitrogen and phosphorus. These can be washed into the ocean via run-off.

(a) (i) State **one** biological molecule that contains **both** elements.

..... [1]

(ii) Complete the sentences.

Nitrogen is essential to organisms to make which are required for cellular repair and growth. Phosphorus and are essential nutrients in the production of bone for marine vertebrates. [2]

(b) Fig. 5.1 shows a pyramid of biomass for a rocky shore.

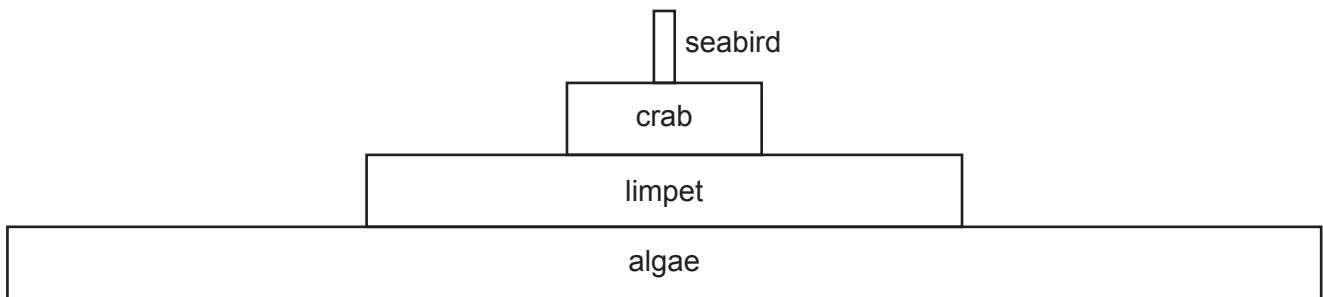


Fig. 5.1

Suggest how the bars on the pyramid would change over time following the input of fertiliser from run-off.

Explain your suggestion.

.....

 [3]

[Total: 6]

6 (a) Describe the main structural features of a typical coral polyp **and** state the function of each feature.

..... [10

- (b)** Biodiversity of a healthy tropical coral reef is very high.

Discuss the importance to the local economy of maintaining high biodiversity on tropical coral reefs.

[6]

[Total: 16]

7 Describe the role of:

- weathering
- erosion
- sedimentation

in the formation of a muddy shore.

[7]

8 Describe how temperature and salinity gradients form in sea water **and** how mixing of these layers can occur.

..... [7]

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