



# Cambridge IGCSE™

CANDIDATE  
NAME

Papadimitriou et al. *Journal of Inequalities and Applications* (2016) 2016:102

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## MARINE SCIENCE

0697/21

## Paper 2 Theory and Practical Skills

May/June 2026

**1 hour 45 minutes**

You must answer on the question paper.

No additional materials are needed.

## INSTRUCTIONS

- 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. Do **not** use correction fluid or tape.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

## INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **20** pages. Any blank pages are indicated.

- 1 Figure 1.1 is a map showing the directions of some oceanic currents.

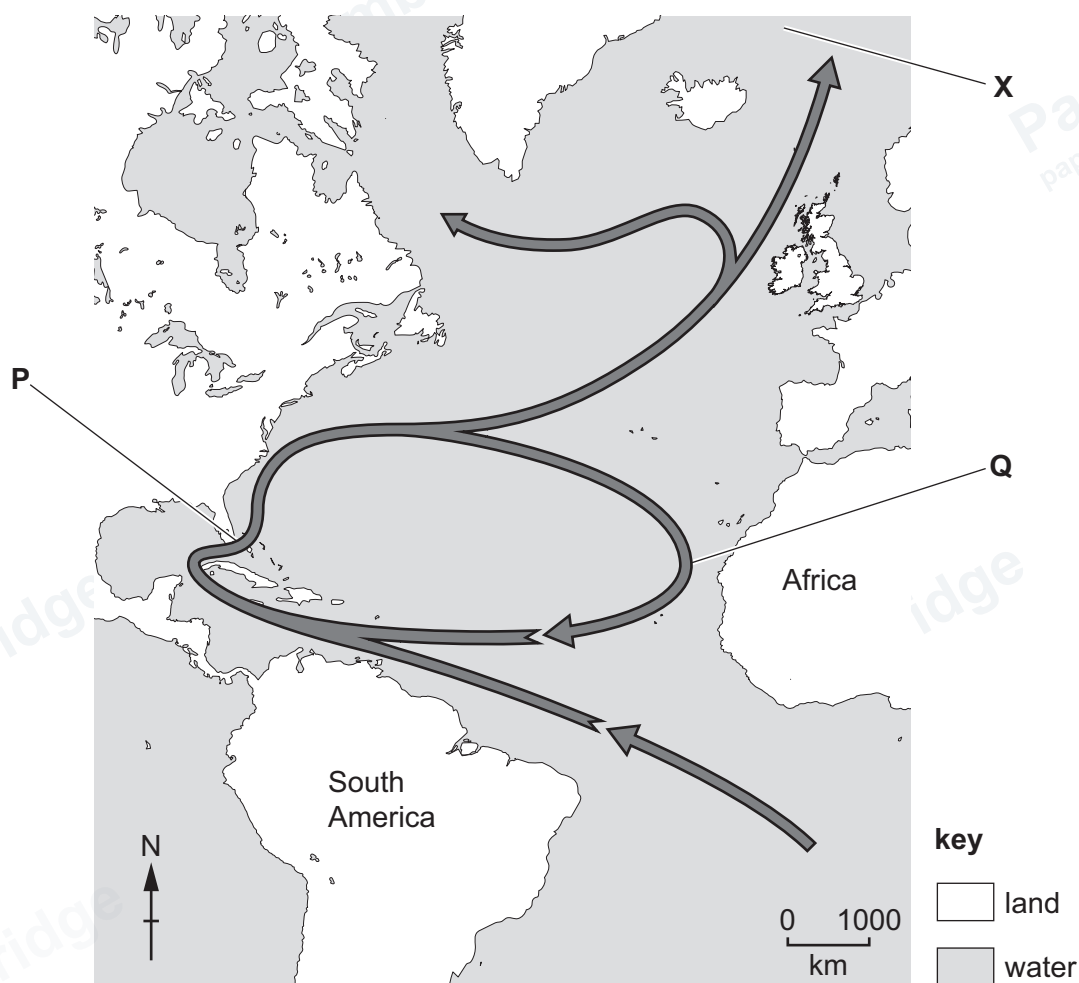


**Figure 1.1**

- (a) (i) State the name of the ocean labelled **X** in Figure 1.1.

..... [1]

- (ii) An object is moved by the oceanic current from point **P** to point **Q** in Figure 1.1.

The total distance travelled by the object is 8250 km.

The current has a mean speed of 0.35 metres per second.

Calculate the time, in days, that the object would take to travel from point **P** to point **Q**.  
Give your answer to the nearest whole number.

[1 day = 86 400 seconds]

time = ..... days [2]

- (iii) Some scientists suggest climate change could cause the currents shown in Figure 1.1 to reverse direction and change in strength.

Leatherback turtles lay eggs on the shores near point **P** shown in Figure 1.1.

Explain why reversing the direction and changing the strength of the currents could have a negative impact on leatherback turtle populations.

Refer to the life cycle of the leatherback turtle in your answer.

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..... [3]

- (b) A group of students investigates the mean current speed of water close to a sandy shore.

- (i) Describe a practical method the students can use to determine the mean current speed of the water.

.....

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.....

.....

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..... [3]

- (ii) Figure 1.2 shows a sign by the shore where the students investigate the mean current speed.



Figure 1.2

Describe the risk that is shown in Figure 1.2 and the precautions the students need to take.

.....

.....

.....

.....

.....

..... [3]

[Total: 12]



2 Figure 2.1 shows part of a giant kelp.

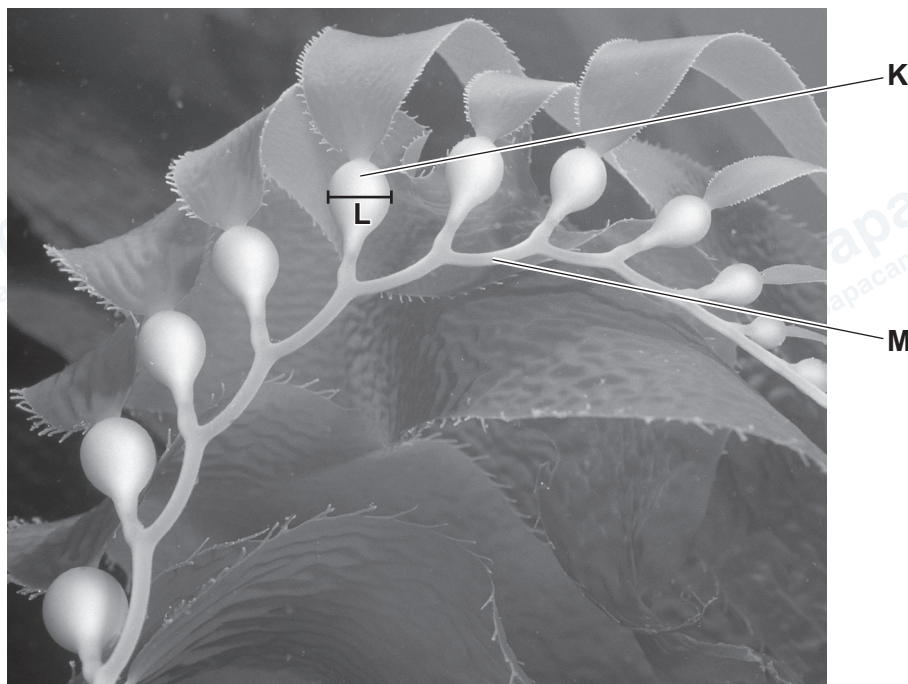


Figure 2.1

(a) (i) Name the structures labelled **K** and **M** in Figure 2.1 and state their functions.

name of **K** .....

function of **K** .....

.....

name of **M** .....

function of **M** .....

.....

[4]

(ii) The image of the giant kelp in Figure 2.1 has a magnification of  $\times 0.5$ .

Calculate the actual width of the structure labelled **K** in Figure 2.1 along the line labelled **L**.

Include the unit.

actual width of structure **K** = ..... [3]

(b) Kelp convert light energy into chemical energy by photosynthesis.

A student uses the following method to investigate the effect of light intensity on the rate of photosynthesis of kelp.

- Cut a disc of tissue from a kelp blade.
- Place the disc into a test-tube filled with sea water.
- Place a lamp at a distance of 5 cm from the test-tube and illuminate the disc.
- Measure the time taken for the disc to rise from the bottom of the test-tube to the surface of the sea water.
- Repeat the experiment with the lamp placed at distances of 10 cm, 15 cm, 20 cm and 25 cm from the test-tube.

Figure 2.2 shows the student's equipment.

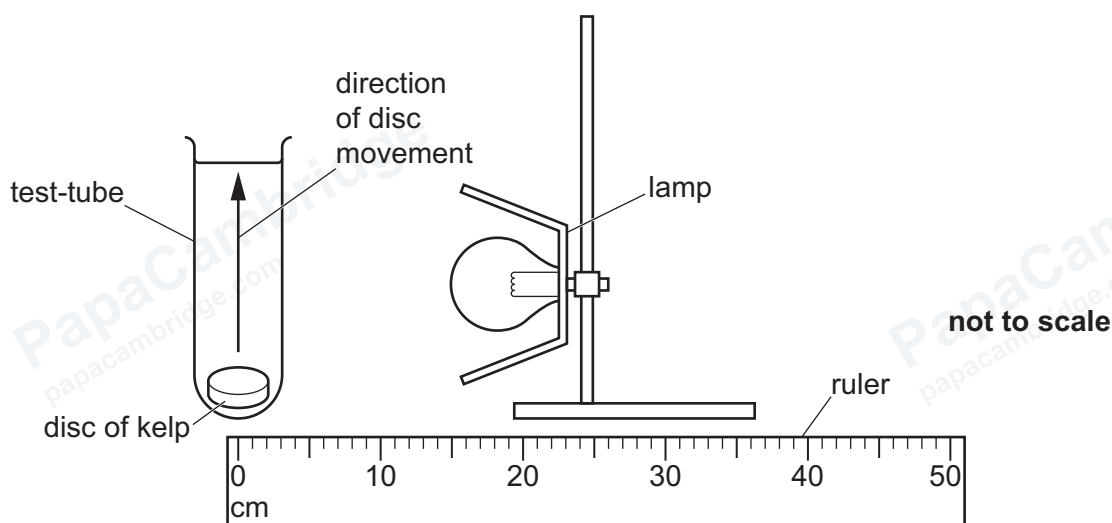


Figure 2.2

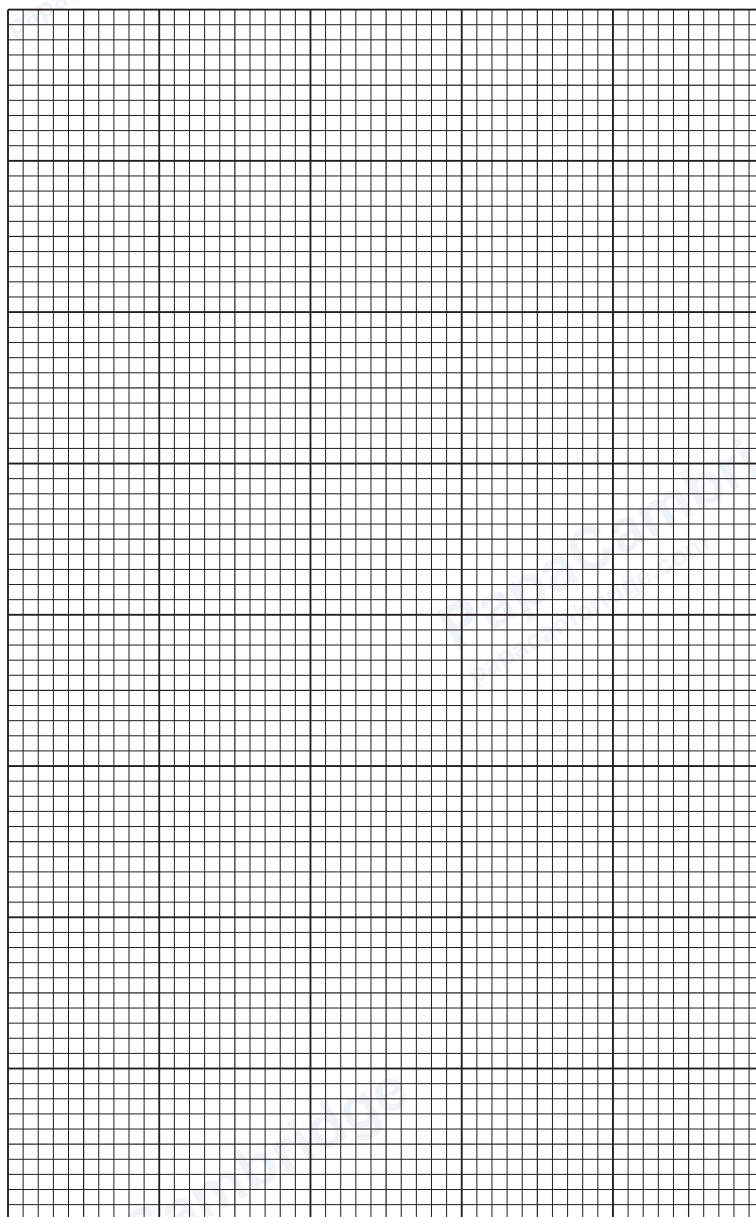
Table 2.1 shows the student's results.

Table 2.1

| distance of lamp<br>from the test-tube<br>/ cm | time taken for disc<br>to rise to surface<br>of sea water / s |
|------------------------------------------------|---------------------------------------------------------------|
| 5                                              | 40                                                            |
| 10                                             | 45                                                            |
| 15                                             | 60                                                            |
| 20                                             | 110                                                           |
| 25                                             | 180                                                           |

(i) Draw a line graph to show the results in Table 2.1.

Join your points with ruled, straight lines.



[4]

- (ii) In each experiment, the student uses a disc of the same size taken from the same kelp blade.

Suggest how the student could keep **one** other named variable constant.

.....

.....

.....

..... [2]

- (iii) Explain the effect of changing light intensity on the time taken for the discs to rise to the surface of the sea water.

Use the information in Table 2.1 to help you with your answer.

.....

.....

.....

.....

.....

..... [3]

[Total: 16]

3 Figure 3.1 shows a larva of a mantis shrimp.

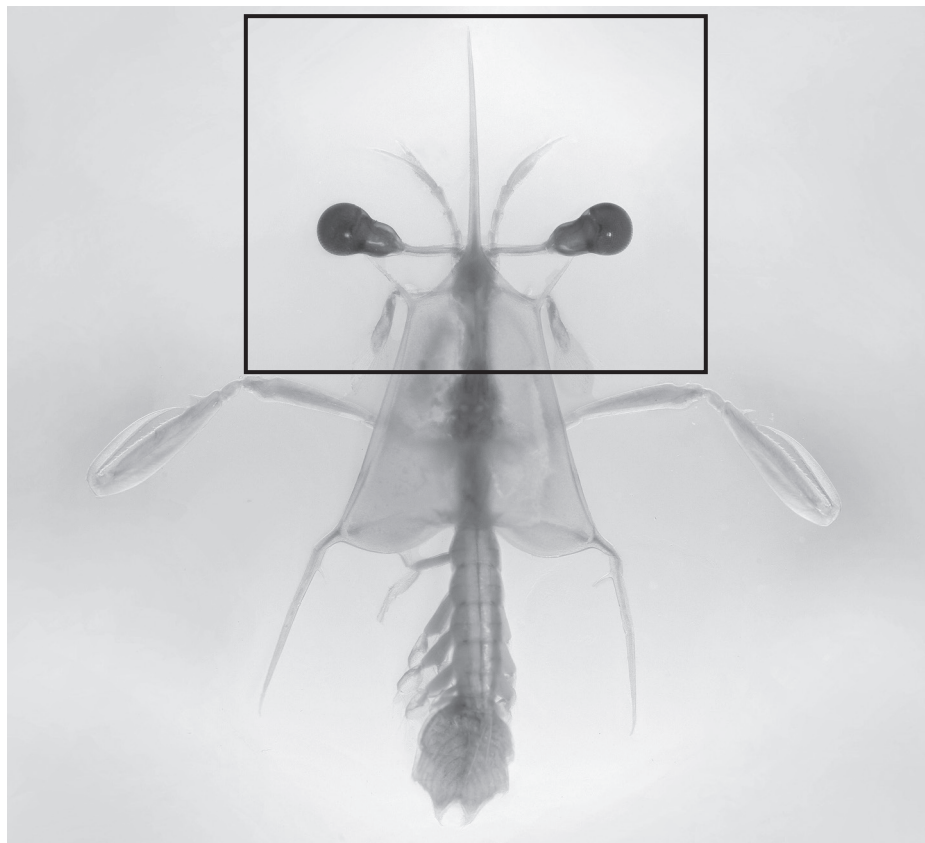


**Figure 3.1**

- (a) (i) Make a large, accurate drawing of the part of the mantis shrimp larva inside the box in Figure 3.1.

[4]



- (ii) Mantis shrimps are classified as crustaceans. Crustaceans and annelids are invertebrates.

State **two** features of crustaceans that are **not** present in annelids.

- 1 .....  
2 ..... [2]

- (b) Some types of shrimp are grown in closed aquaculture systems.

- (i) State what is meant by a closed aquaculture system.

.....  
..... [1]

- (ii) Water in aquaculture systems that is released into the ocean can have a different salinity and density compared with ocean water.

Describe a method to investigate the effect of salinity on the density of water.

.....  
.....  
.....  
.....  
.....  
..... [3]

- (iii) Describe how shrimps should be fed in an aquaculture system to maximise their growth while limiting the environmental impact.

.....  
.....  
.....  
.....  
.....  
..... [3]



(iv) Table 3.1 shows the results of laboratory tests on food given to shrimps.

Water is added to a small amount of the food, and the mixture formed is stirred.

Samples of the mixture are analysed using different food tests.

**Table 3.1**

| food test                        | result              |
|----------------------------------|---------------------|
| addition of iodine solution      | yellow/brown colour |
| addition of biuret solution      | lilac/purple colour |
| heating with Benedict's solution | orange colour       |

Use the results of the food tests shown in Table 3.1 to identify the nutrients present in the food.

..... [1]

[Total: 14]

- 4 A group of students investigates the populations of shelled molluscs on a sandy shore.

- (a) Table 4.1 shows features of the shells of four types of shelled molluscs found on the shore.

**Table 4.1**

| name of shelled mollusc | feature of shell |        |                       |
|-------------------------|------------------|--------|-----------------------|
|                         | colour           | shape  | number of shell parts |
| turret shell            | white            | spiral | one                   |
| topshell snail          | brown            | spiral | one                   |
| cowrie                  | brown            | flat   | one                   |
| scallop                 | brown            | flat   | two                   |

Complete Figure 4.1 to produce a dichotomous key for the shelled molluscs using the features in Table 4.1.

|                                          |                            |
|------------------------------------------|----------------------------|
| <b>1a</b> colour of shell is white       | shelled mollusc is a ..... |
| <b>1b</b> colour of shell is .....       | <b>go to 2</b>             |
| <b>2a</b> number of shell parts is two   | shelled mollusc is a ..... |
| <b>2b</b> number of shell parts is ..... | <b>go to 3</b>             |
| <b>3a</b> .....                          | shelled mollusc is a ..... |
| <b>3b</b> .....                          | shelled mollusc is a ..... |

**Figure 4.1**

[3]

- (b) The students use the following method to estimate the population of topshell snails on the shore.

**step 1** Find an area of sand on the shore where topshell snails are present.

**step 2** Place a 1 m<sup>2</sup> quadrat over this area.

**step 3** Count the number of topshell snails inside the quadrat.

Repeat steps 1–3 with four more quadrats, and calculate the mean number of topshell snails per square metre. Use the mean number of topshell snails per square metre and the total area of the shore to estimate the population of topshell snails on the shore.

The students' results are shown in Table 4.2.



Table 4.2

| quadrat | number of topshell snails<br>inside the 1 m <sup>2</sup> quadrat |
|---------|------------------------------------------------------------------|
| 1       | 22                                                               |
| 2       | 5                                                                |
| 3       | 8                                                                |
| 4       | 34                                                               |
| 5       | 26                                                               |

- (i) Calculate the mean number of topshell snails per square metre using the information in Table 4.2.

mean number of topshell snails per square metre = ..... [2]

- (ii) The total area of the shore is 250 m<sup>2</sup>.

Use your answer to **4(b)(i)** to calculate the estimated population of topshell snails on the shore.

estimated population of topshell snails on the shore = ..... [1]

- (iii) Explain how the students can improve the method to give a more accurate estimate of the population of topshell snails on the shore.

.....

.....

.....

.....

.....

.....

.....

.....

..... [3]



- (c) The students notice that the moisture content of the sand on the shore is different in areas where many large rocks are present compared with areas with no large rocks.

Describe an investigation the students could safely carry out to test whether the presence of large rocks on the shore affects the moisture content of the sand.

[illegible]

[Total: 15]





Turn over



- 5 Fossil fuels are a source of energy. The use of fossil fuels for energy has advantages and disadvantages.

(a) State **two** advantages of using fossil fuels as a source of energy.

1 .....

2 .....

[2]

- (b) One disadvantage of using fossil fuels is pollution from oil spills. The use of dispersant chemicals to remove oil spills in sea water can reduce their impact on marine ecosystems.

Outline **other** strategies for reducing the impact of oil spills on marine ecosystems.

.....

.....

.....

.....

.....

[3]

- (c) The use of fossil fuels can result in an increase of atmospheric carbon dioxide.

A student investigates the effect of increased atmospheric carbon dioxide on the pH of sea water.

The student bubbles carbon dioxide through samples of sea water for different lengths of time. The student then measures the pH of the sea water using a pH meter.

Figure 5.1 shows the student's results.

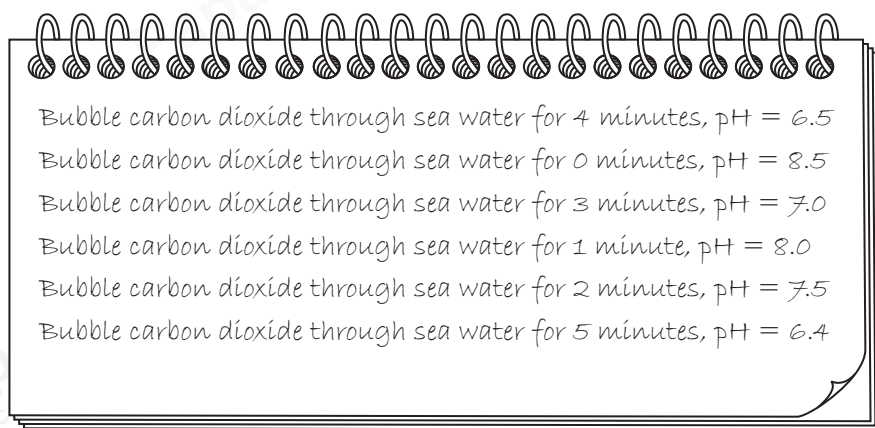


Figure 5.1

- (i) Draw a suitable table for recording the results shown in Figure 5.1.

In your table, write the results in order of increasing time that the carbon dioxide gas is bubbled through the sea water.

[4]

- (ii) The student concludes that increased use of fossil fuels causes ocean acidification.

Evaluate whether the results in Figure 5.1 support the student's conclusion.

[3]

[Total: 12]

- 6 Table 6.1 shows the percentages by mass of some of the chemical compounds present in a fertiliser used on crop fields.

Table 6.1

| chemical compound  | percentage by mass |
|--------------------|--------------------|
| ammonium phosphate | 30                 |
| calcium carbonate  | 19                 |
| iron sulfate       | 1                  |
| magnesium sulfate  | 2                  |
| other compounds    | 48                 |

- (a) (i) Use the data in Table 6.1 to calculate the mass of calcium carbonate, in grams, present in 17 kg of the fertiliser.

Give your answer to **two** significant figures.

mass of calcium carbonate = .....g [2]

- (ii) Describe the differences between a mixture and a chemical compound.

Use Table 6.1 to help you with your answer.

.....  
 .....  
 .....  
 ..... [2]

- (iii) Calcium carbonate is a source of calcium.

Explain **one** role of calcium in marine organisms.

.....  
 .....  
 .....  
 ..... [2]





**(b)** Figure 6.1 shows a warning sign at the coast near a crop field where the fertiliser is used.



### Figure 6.1

Ammonium phosphate is a source of nitrogen and phosphorus.

Explain why using large quantities of the fertiliser on the crop field can lead to algal blooms and the death of fish in the nearby sea.

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[5]

[5]

[Total: 11]





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