

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	



General Certificate of Secondary Education
Higher Tier
June 2014

Additional Science

Unit Biology B2

BL2HP

H

Biology

Unit Biology B2

Tuesday 13 May 2014 9.00 am to 10.00 am

For this paper you must have:

- a ruler.
- You may use a calculator.

Time allowed

- 1 hour

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 2 should be answered in continuous prose.
In this question you will be marked on your ability to:
 - use good English
 - organise information clearly
 - use specialist vocabulary where appropriate.

Advice

- In all calculations, show clearly how you work out your answer.



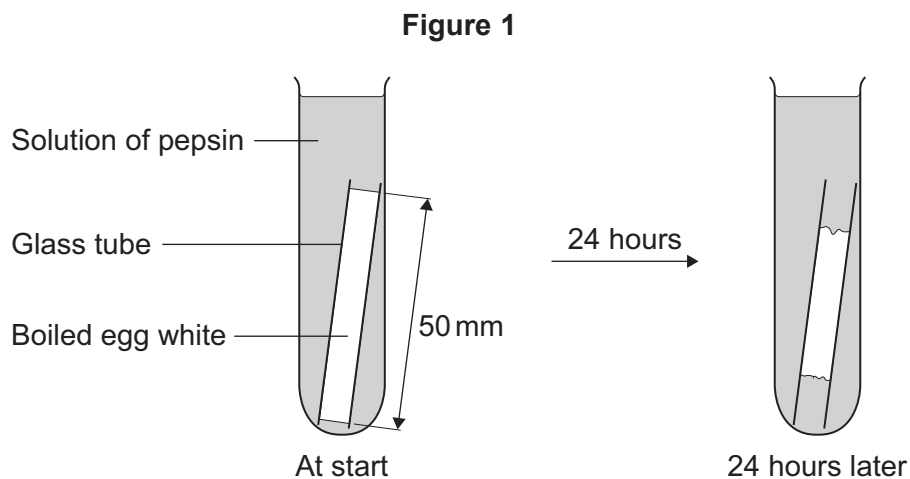
Answer **all** questions in the spaces provided.

- 1** Some students investigated the effect of pH on the digestion of boiled egg white by an enzyme called pepsin. Egg white contains protein.

The students:

- put a glass tube containing boiled egg white into a test tube
- added a solution containing pepsin at pH 7
- set up six more tubes with solutions of pepsin at different pH values
- left the test tubes for 24 hours at room temperature.

Figure 1 shows one of the test tubes, at the start and at the end of the 24 hours.



- 1 (a) (i)** Name the product of protein digestion.

[1 mark]

.....

- 1 (a) (ii)** What type of enzyme digests protein?

Tick (✓) **one** box.

[1 mark]

amylase

lipase

protease



1 (b) The egg white in each tube was 50 mm long at the start of the investigation. Table 1 shows the students' results.

Table 1

pH	Length in mm of boiled egg white after 24 hours
1	38
2	20
3	34
4	45
5	50
6	50
7	50

1 (b) (i) At which pH did the pepsin work best?

[1 mark]

pH

1 (b) (ii) The answer you gave in part (b)(i) may not be the exact pH at which pepsin works best.

What could the students do to find a more accurate value for this pH?

[2 marks]

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1 (b) (iii) There was no change in the length of the egg white from pH 5 to pH 7.

Explain why.

[2 marks]

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Question 1 continues on the next page

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1 (c) Pepsin is made by the stomach.

Name the acid made by the stomach which allows pepsin to work well.

[1 mark]

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8



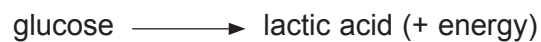
3 **Figure 2** shows an athlete running on a treadmill.

Figure 2



After running for several minutes, the athlete's leg muscles began to ache. This ache was caused by a high concentration of lactic acid in the muscles.

3 (a) The equation shows how lactic acid is made.



Name the process that makes lactic acid in the athlete's muscles.

[1 mark]

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3 (b) Scientists investigated the production of lactic acid by an athlete running at different speeds.

In the investigation:

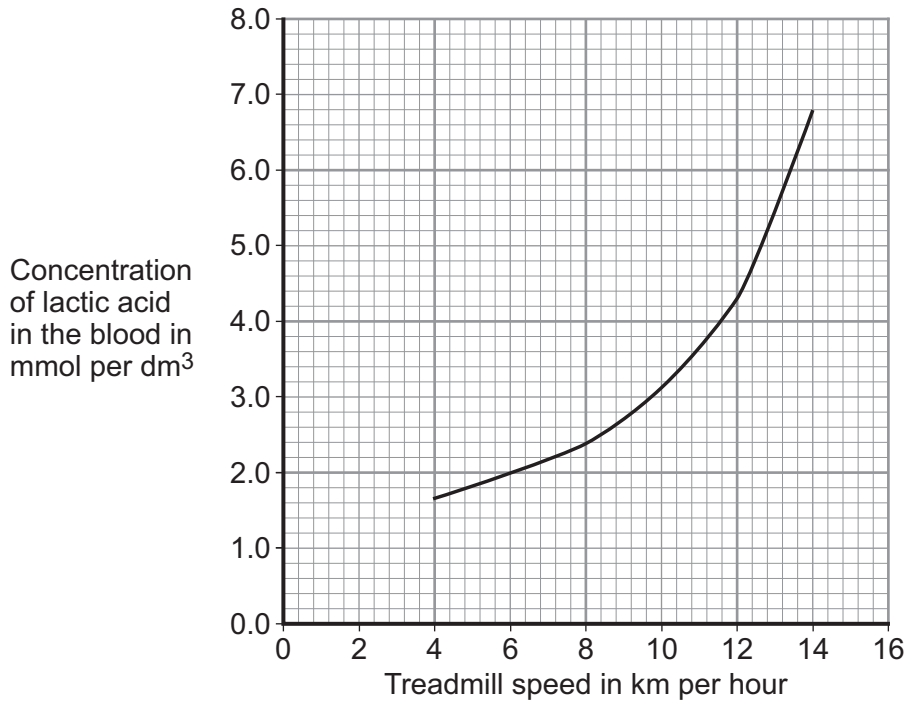
- the athlete ran on the treadmill at 4 km per hour
- the scientists measured the concentration of lactic acid in the athlete's blood after 2 minutes of running.

The investigation was repeated for different running speeds.

Figure 3 shows the scientists' results.



Figure 3



3 (b) (i) How much more lactic acid was there in the athlete's blood when he ran at 14 km per hour than when he ran at 8 km per hour?

[2 marks]

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Answer = mmol per dm³

3 (b) (ii) Why is more lactic acid made in the muscles when running at 14 km per hour than when running at 8 km per hour?

[3 marks]

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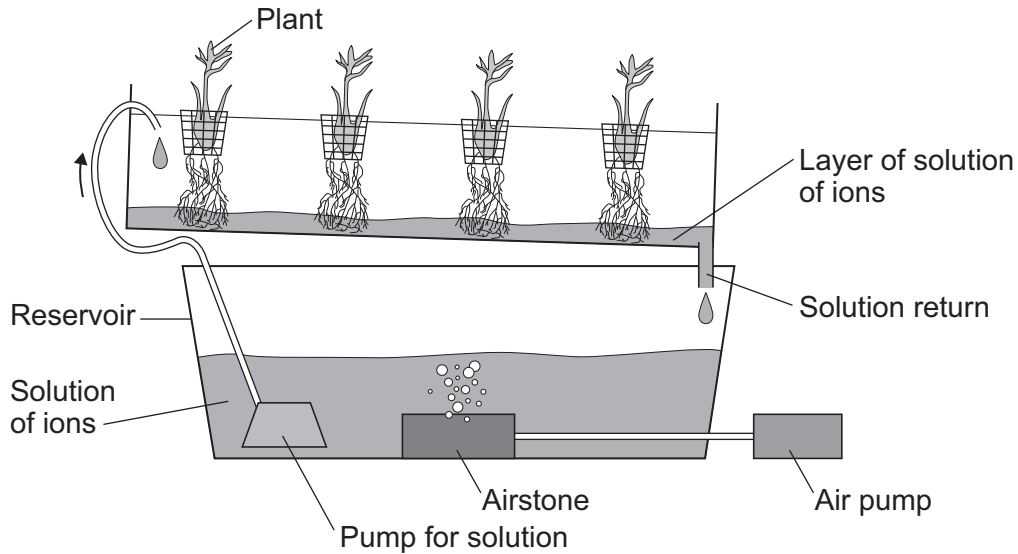
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4 Farmers sometimes grow crops in greenhouses without using any soil.

Figure 4 shows one way this can be done.

Figure 4



The pump for the solution sends water and ions to the plant roots.
The solution flows slowly past the roots and returns to the reservoir.
The concentration of the ions in the solution and its pH are controlled automatically.

4 (a) (i) It is an advantage to give ions to the plants as shown in Figure 4 instead of growing the plants in a container of soil.

Give **one** reason why.

[1 mark]

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4 (a) (ii) The air pump and airstone make bubbles of air in the solution of ions.
Gases from the air will dissolve in the solution.

Explain how this helps to keep the plants' roots alive.

[3 marks]

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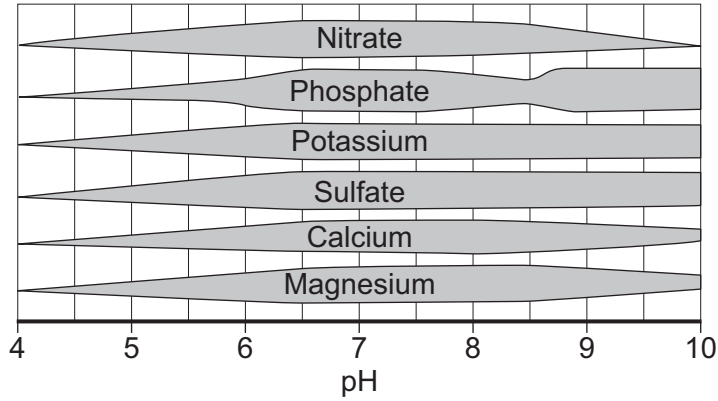
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4 (b) **Figure 5** shows how easy it is for plants to take in some ions at different pH values. The thicker the bar in **Figure 5**, the easier it is for the plants to take in the ion.

Figure 5



4 (b) (i) The plants will grow better if the farmer keeps the solution at pH 7.

Use information from **Figure 5** to suggest why.

[1 mark]

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4 (b) (ii) Each molecule of chlorophyll contains a magnesium ion.

Why do plants need magnesium ions for healthy growth?

[2 marks]

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4 (b) (iii) Name **one** ion that plants take in to supply them with nitrogen.

[1 mark]

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4 (b) (iv) Give **one** reason why plants need a supply of the element nitrogen.

[1 mark]

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Turn over ►

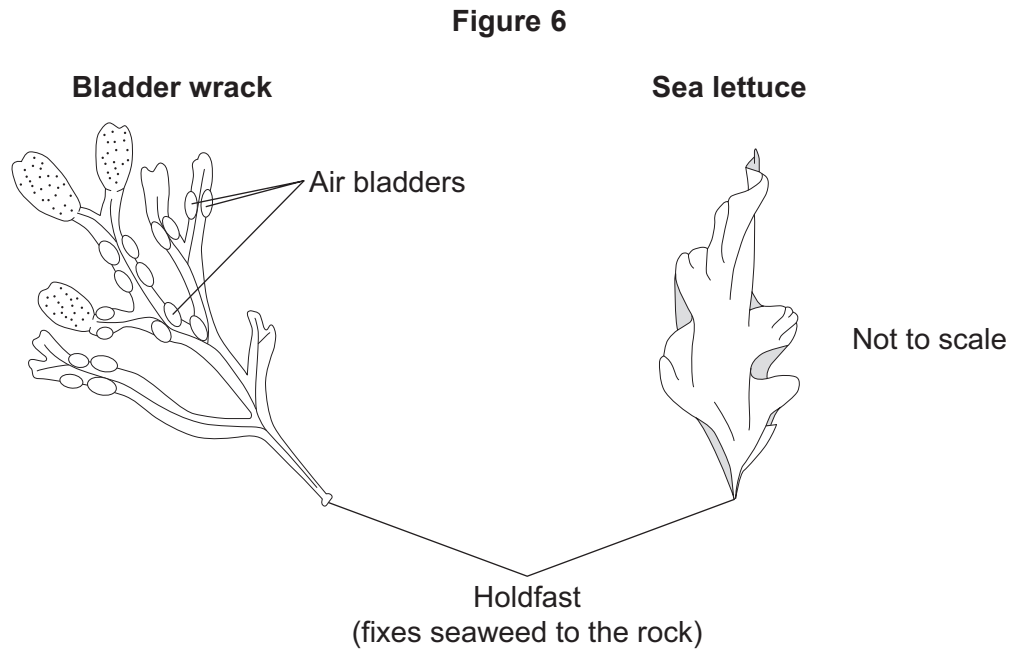


5 At the seashore, the tide comes in and goes out twice each day.

Some students investigated whether two different species of seaweed could live only at certain positions on a rocky shore.

Seaweeds are plant-like organisms that make their food by photosynthesis.

Figure 6 shows the two species of seaweed that the students investigated.



5 (a) The students:

- 1 placed a 50-metre tape measure on the rocks at right angles to the sea
- 2 placed a quadrat next to the tape measure
- 3 recorded whether each species was present or not.

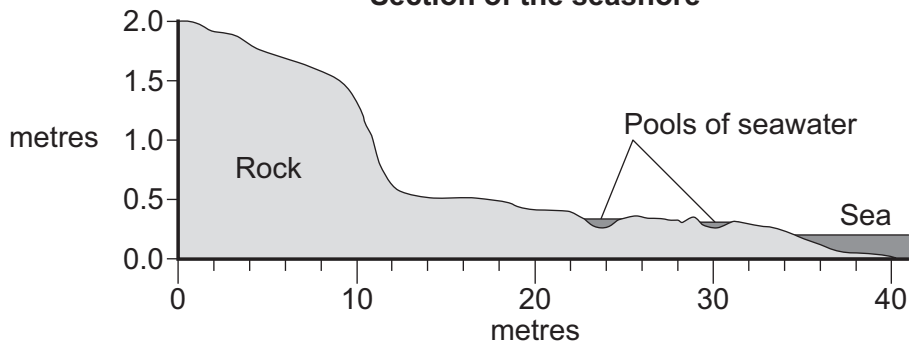
The students repeated steps 2 and 3 every metre down the shore.

Figure 7 shows a section of the seashore and the students' results.

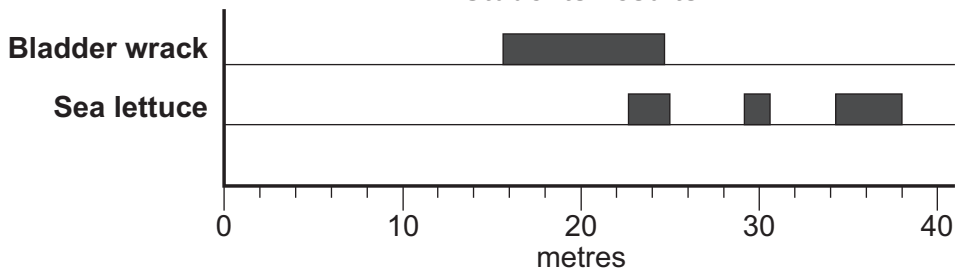


Figure 7

Section of the seashore



Students' results



5 (a) (i) The students placed the quadrat at regular intervals along a transect line rather than placing the quadrat at random positions anywhere on the rocky shore.

Explain why.

[2 marks]

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5 (a) (ii) How could the students have improved their investigation to ensure that they produced valid data?

[2 marks]

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Question 5 continues on the next page

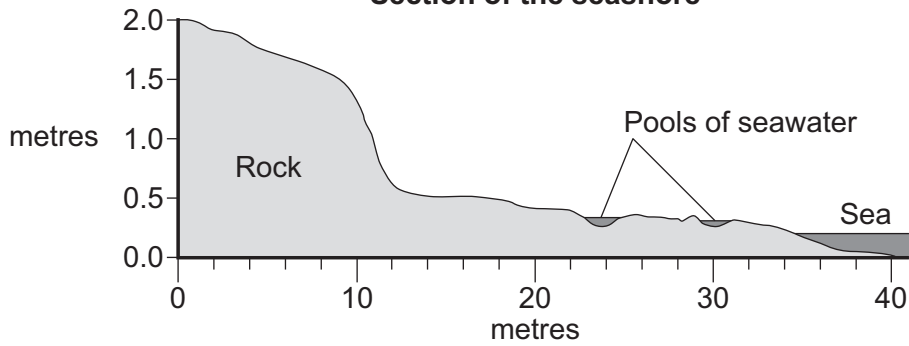
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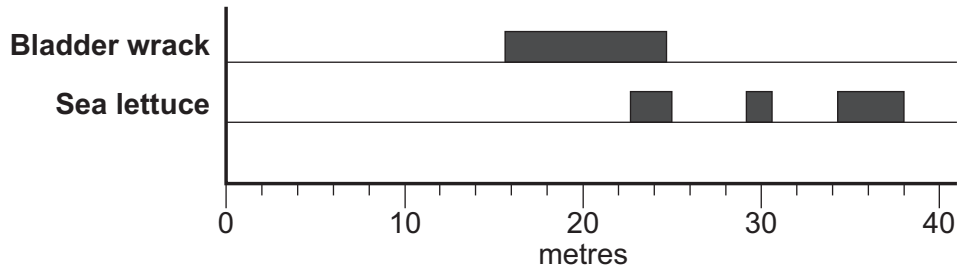
5 (a) (iii) Figure 7 is repeated here to help you answer this question.

Figure 7

Section of the seashore



Students' results



The students concluded that bladder wrack is better adapted than sea lettuce to survive in dry conditions.

What is the evidence for this conclusion?

Use information from **Figure 7**.

[2 marks]

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5 (b) The bladder wrack has many air bladders.
The air bladders help the bladder wrack to float upwards when the sea covers it.

Suggest how this helps the bladder wrack to survive.

[2 marks]

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8

Turn over for the next question

Turn over ►



6 Phenylketonuria (PKU) is an inherited condition. PKU makes people ill.

6 (a) PKU is caused by a recessive allele.

6 (a) (i) What is an allele?

[1 mark]

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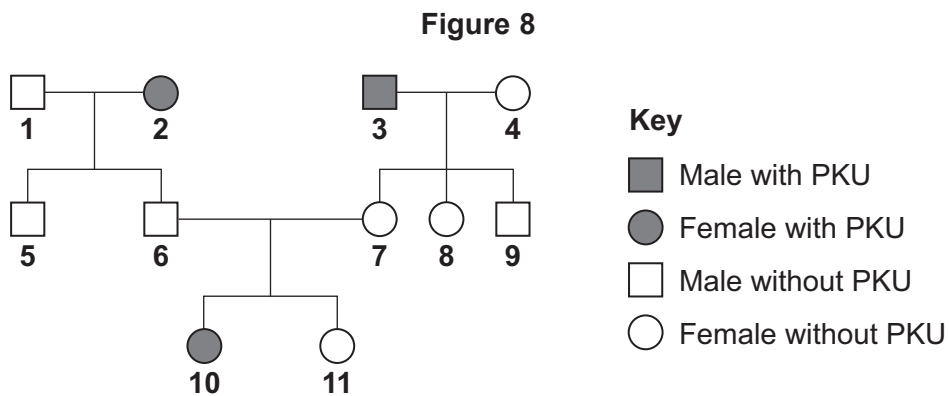
6 (a) (ii) What is meant by recessive?

[1 mark]

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6 (b) Figure 8 shows the inheritance of PKU in one family.



6 (b) (i) Give **one** piece of evidence from **Figure 8** that PKU is caused by a recessive allele.

[1 mark]

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- 6 (b) (ii)** Persons **6** and **7** are planning to have another child.
Use a genetic diagram to find the probability that the new child will have PKU.

Use the following symbols in your answer:

N = the dominant allele for **not** having PKU

n = the recessive allele for PKU.

[4 marks]

Probability =

- 6 (c)** Persons **6** and **7** wish to avoid having another child with PKU.

A genetic counsellor advises that they could produce several embryos by IVF treatment.

- 6 (c) (i)** During IVF treatment, each fertilised egg cell forms an embryo by cell division.

Name this type of cell division.

[1 mark]

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- 6 (c) (ii)** An embryo screening technique could be used to find the genotype of each embryo.

An unaffected embryo could then be placed in person **7**'s uterus.

The screening technique is carried out on a cell from an embryo after just three cell divisions of the fertilised egg.

How many cells will there be in an embryo after the fertilised egg has

divided three times?

[1 mark]

Question 6 continues on the next page

Turn over ►



6 (c) (iii) During embryo screening, a technician tests the genetic material of the embryo to find out which alleles are present.

The genetic material is made up of large molecules of a chemical substance.

Name this chemical substance.

[1 mark]

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6 (d) Some people have ethical objections to embryo screening.

6 (d) (i) Give **one** ethical objection to embryo screening.

[1 mark]

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6 (d) (ii) Give **one** reason in favour of embryo screening.

[1 mark]

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12



Turn over for the next question

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ANSWER IN THE SPACES PROVIDED**

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7 (a) Fossils provide evidence for what early life forms were like. From the evidence, scientists think that life began on Earth more than 3 billion years ago.

Many early life forms were soft-bodied.

Explain why this makes it difficult for scientists to be certain about what these early life forms were like.

[2 marks]

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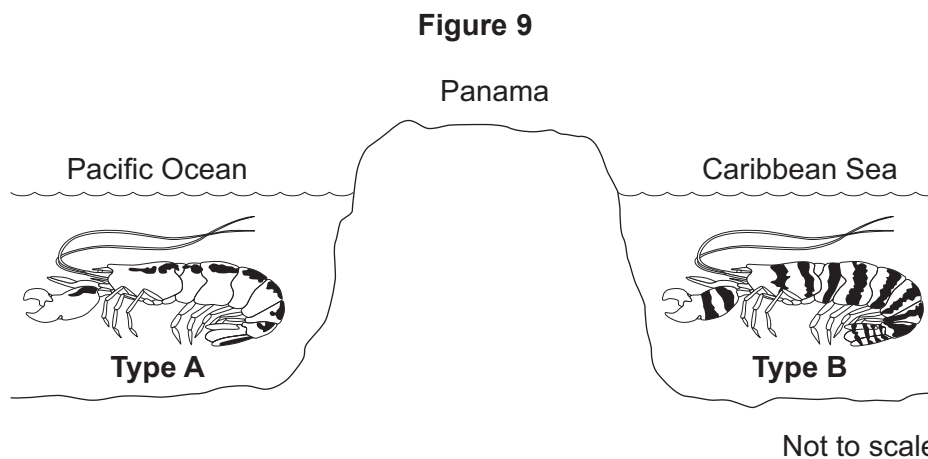
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7 (b) **Figure 9** shows two types of pistol shrimp.

The shrimps live in shallow, tropical seas on opposite sides of Panama.



Scientists put one **Type A** shrimp and one **Type B** shrimp together in a tank of seawater.

The two types of shrimp snapped their claws aggressively at each other. They did not mate.

The scientists said that this was evidence for the **Type A** and **Type B** shrimps being classified as two different species.

7 (b) (i) Give **one** reason why the scientists' opinion may be correct.

[1 mark]

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7 (b) (ii) Suggest **two** reasons why the scientists' opinion may **not** be correct.

[2 marks]

1

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2

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7 (c) Panama is a narrow strip of land which today joins North America and South America. It was formed by land moving up from beneath the sea. Panama has separated the Pacific Ocean and the Caribbean Sea for the past 3 million years.

Explain how two different species of pistol shrimp could have developed from an ancestral species of shrimp.

[6 marks]

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11

END OF QUESTIONS



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Figure 2: © Getty Images

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