

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

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General Certificate of Secondary Education  
June 2004



**BIOLOGY (MODULAR) SPECIFICATION A  
HIGHER TIER**

**3413/H**

Monday 7 June 2004 1.30 pm to 3.00 pm

**H**

**In addition to this paper you will require:**  
a ruler.  
You may use a calculator.

For Examiner's Use			
Number	Mark	Number	Mark
1		9	
2		10	
3		11	
4		12	
5		13	
6		14	
7		15	
8			
Total (Column 1)	→		
Total (Column 2)	→		
TOTAL			
Examiner's Initials			

Time allowed: 1 hour 30 minutes

**Instructions**

- Use blue or black ink or ball-point pen. Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want marked.

**Information**

- The maximum mark for this paper is 90.
- Mark allocations are shown in brackets.
- You are reminded of the need for good English and clear presentation in your answers.

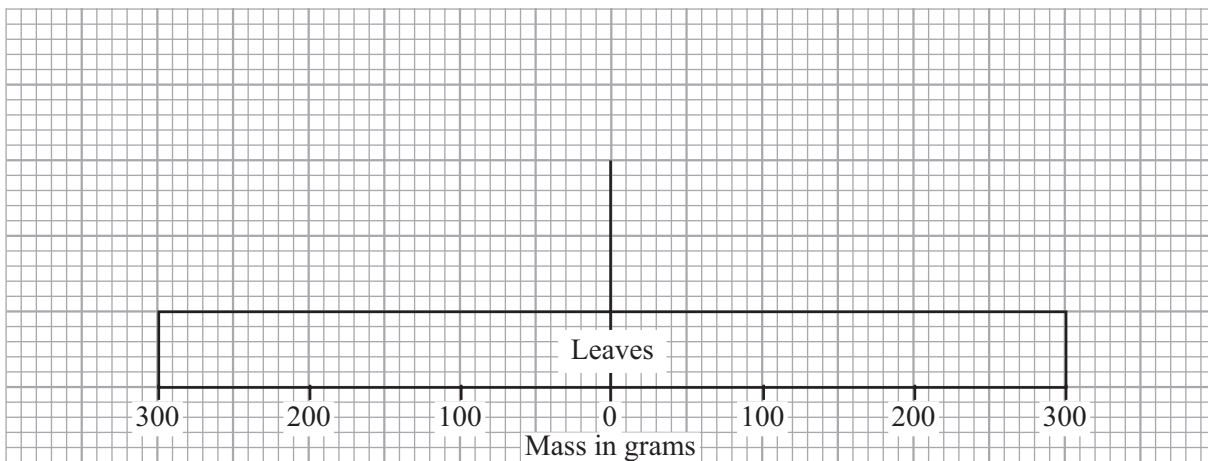
## ENVIRONMENT

- 1 A group of students examined a sample of leaf litter from an area of oak woodland. They weighed the leaves. They captured and identified all the animals that they could find in the leaf litter. They then divided the animals into two feeding types, those which feed on leaves and those which feed on small animals. They weighed each sample.

The results are shown in the table.

Sample	Mass in grams
Leaves	600
Animals feeding on leaves	80
Animals feeding on small animals	20

- (a) Complete the pyramid of biomass for these results.



(2 marks)

- (b) What fraction of biomass in the leaf litter is transferred to the animals which feed on it?

.....

(1 mark)

- (c) (i) Much of the biomass transferred to the small animals is used in respiration.

Why does respiration make the biomass decrease?

.....  
 .....  
 (1 mark)

- (ii) Give **two** ways in which the animals might use the energy released in respiration.

1.....  
 2.....  
 (2 marks)

- (d) Give **two** other reasons why the biomass in the leaves might not be transferred to the animals.

1.....  
 2.....  
 (2 marks)

8

- 2 A gardener bought a compost bin to produce compost from his grass cuttings as they decayed. After six months there was little sign of decay.

Describe and explain **two** ways in which he could speed up decay.

What he could do to speed up decay	Explanation
1	
2	

(4 marks)

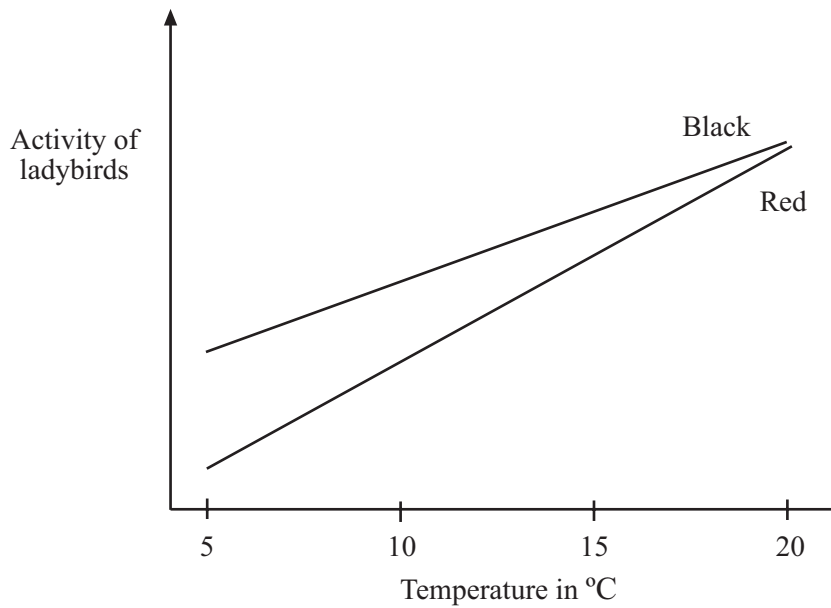
4

Turn over ►

**INHERITANCE AND SELECTION**

- 3 There are two kinds of ladybird, red with black spots and black with red spots. The black form is more common in the north of Britain, where it is colder. The difference in the two forms is due to a difference in their genes.

Scientists think that temperature affects the distribution of the two forms of ladybird in Britain. They measured the activity of the two types of ladybird at different temperatures. The result of the investigation is shown in the graph.



- (a) Describe how temperature affects the activity of both forms of ladybird.

.....

.....

.....

.....

(3 marks)

- (b) In another investigation, equal numbers of black and red ladybirds were introduced into a habitat with an average temperature of 5 °C.

What would happen to the proportion of black and red ladybirds in the population over several generations? Explain your answer.

*To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.*

.....

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(4 marks)

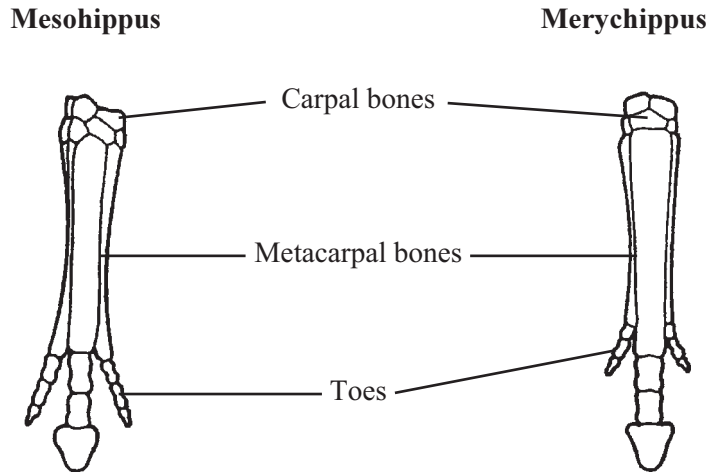


**TURN OVER FOR THE NEXT QUESTION**

**Turn over** ►

- 4 Mesohippus and Merychippus are ancestors of the modern horse. Mesohippus lived about 38 million years ago and Merychippus lived about 26 million years ago.

The diagrams show the arrangement of some of the bones in the front leg of each animal.



Source: ROLAND SOPER, NIGEL P. O. GREEN, G. WILFRED STOUT, DENNIS J. TAYLOR  
*Biological Science 2*, (Cambridge University Press), 1990

- (a) Describe **two** ways in which the arrangement of these bones is different.

1 .....

.....

2 .....

.....

(2 marks)

- (b) How do scientists find out about the structure of animals that lived so long ago?

.....

.....

(1 mark)

- (c) Suggest how scientists would know that Mesohippus lived 12 million years before Merychippus.

.....

.....

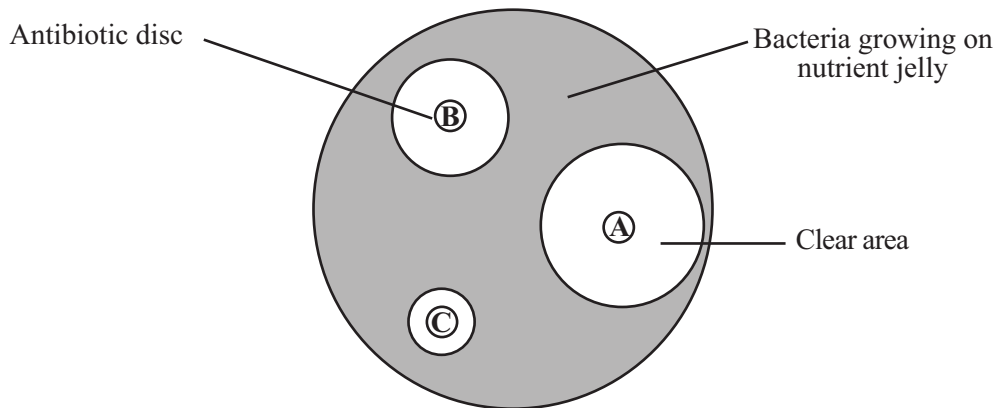
(1 mark)

## BIOLOGY IN ACTION

- 5 A student did an experiment to compare the effect of three different antibiotics on the bacterium, *E. coli*.

He spread bacteria over the surface of a petri dish which contained sterile nutrient jelly. He then soaked filter paper discs in three different antibiotics and placed them on the surface of the jelly.

The diagram shows the appearance of the dish after 3 days.



- (a) Give the letter of the antibiotic which is the most effective against this bacterium.

.....  
(1 mark)

- (b) Explain why there are clear areas around the antibiotic discs.

.....  
.....  
(2 marks)

- (c) Explain why antibiotics cannot be used to treat diseases caused by viruses.

.....  
.....  
.....  
(2 marks)

6 Read the following extracts.

The extracts have been removed due to third-party copyright constraints.

The three extracts gave the following information:

Government trying to avoid major public health emergency - falling public confidence in MMR vaccine.

Blair accuses critics of scaremongering.

Medical bodies issue statement backing safety of vaccine.

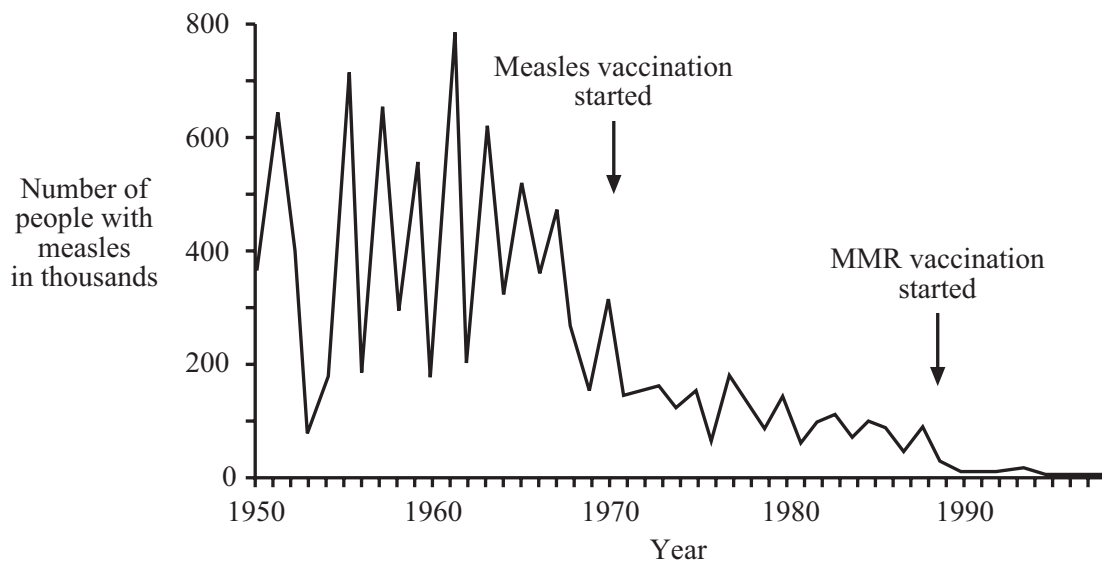
Number of cases of measles in first seven weeks of 2002 equalled total for last year. Most in South London.

Parents shunning jab because of fears that it is linked to autism and bowel disease.

Fears about side-effects caused vaccination rates to fall to a record low.



The graph shows the change in the number of cases of measles in England and Wales between 1950 and 1998.



Source: Office for National Statistics and Department of Health. Crown copyright material is reproduced with permission of the Controller of HMSO and the Queen's Printer for Scotland.

(a) Suggest reasons why some parents in South London refused to have their children vaccinated against measles in 2002.

.....

.....

.....

(2 marks)

(b) Parents can get information from sources such as newspapers or the internet. Why should they not rely totally on such information?

.....

.....

(1 mark)

(c) Suggest how scientists might show whether there is a link between the MMR vaccination and autism.

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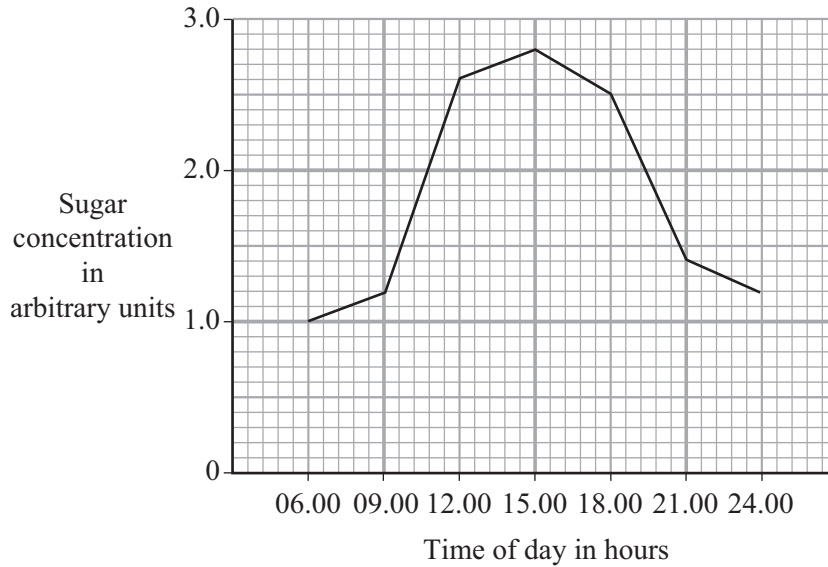
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(2 marks)

Turn over ▶

QUESTIONS RELATING TO PREVIOUSLY TESTED MODULES

7 The graph shows how the concentration of sugar in the leaves of a plant varies during a summer's day.



(a) Give the time when the sugar concentration is the highest.

.....  
(1 mark)

(b) Plants use some of this sugar for respiration. How will the plant use the sugar **not** used in respiration?

.....  
.....  
(1 mark)

(c) In which 3 hour period does the sugar concentration in the leaves of this plant increase the fastest?

.....  
(1 mark)

(d) Give **two** reasons why the concentration of sugar increases fastest during this period.

.....  
.....  
(2 marks)

8 The table shows the amounts of some substances filtered and excreted by the kidneys each day.

Substance	Mass filtered by the kidneys each day in grams	Mass excreted in the urine each day in grams
Sodium ions	600	3
Glucose	180	0
Urea	50	30

(a) What is the mass of sodium ions reabsorbed into the bloodstream each day?

..... g. (1 mark)

(b) What is the percentage of urea excreted each day?

.....  
 .....  
 .....  
 ..... % (2 marks)

(c) In which organ of the body is urea made?

.....  
(1 mark)

(d) What change to the diet might result in an increase in the urea content of the urine? Explain your answer.

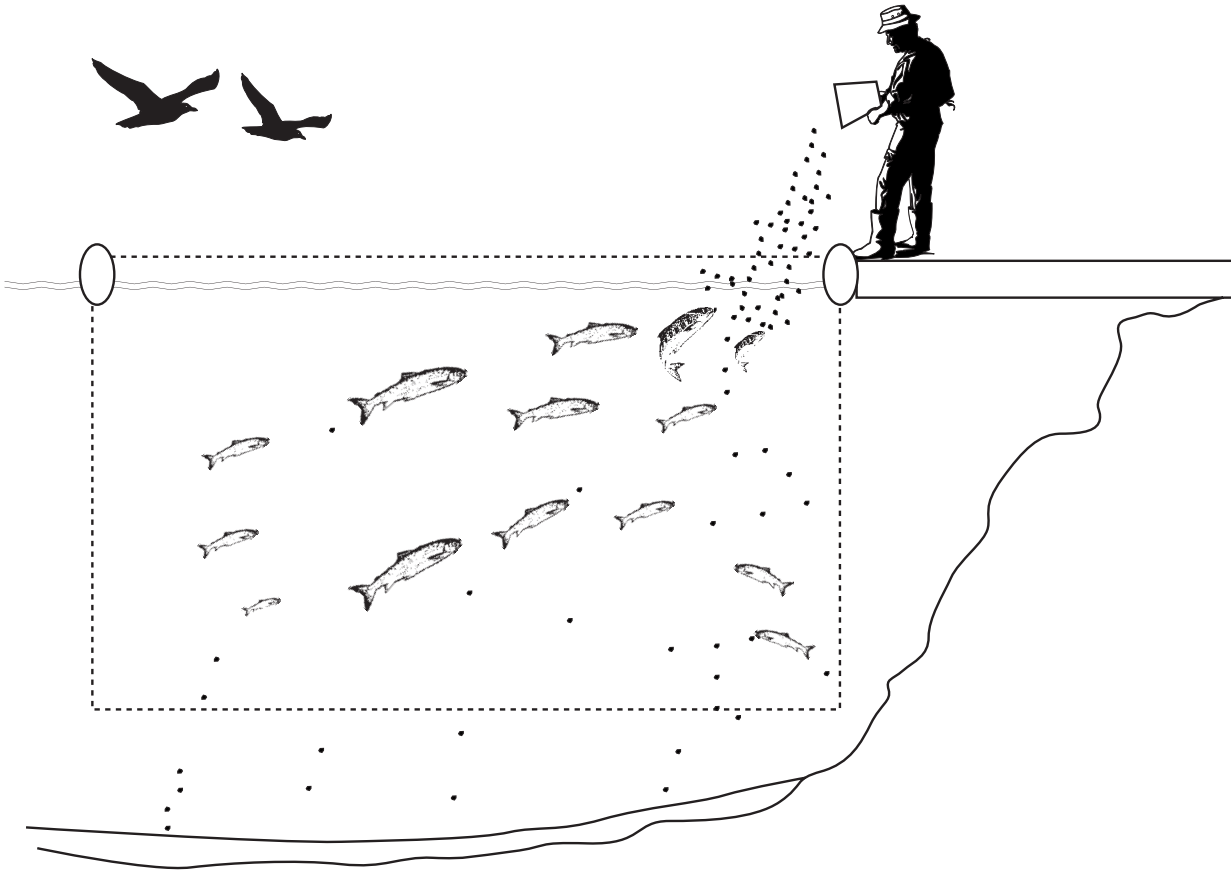
.....  
 .....  
 .....  
(2 marks)

6

Turn over ►

ENVIRONMENT

9



Salmon farming in Scotland's sea lochs produces over 130 000 tonnes of fish each year. People now eat more farmed salmon than wild salmon.

(a) Describe and explain the advantages and disadvantages of farming salmon.

*To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.*

Advantages .....

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Disadvantages.....  
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(6 marks)

(b) The uneaten food and the waste from the salmon fall to the sea bed.

Describe how the nitrogenous compounds in the uneaten food and the waste from the salmon can eventually form proteins in aquatic plants.

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(5 marks)

11

**TURN OVER FOR THE NEXT QUESTION**

**Turn over** ►

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**INHERITANCE AND SELECTION**

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**10** The flounder is a fish that has a gene for making an anti-freeze chemical.

Scientists have transferred this gene to cells from tomato plants. These cells then grow in tissue culture. Hormones are added to encourage the growing cells to develop into small tomato plants. Plants grown in this way are resistant to damage caused by low temperatures.

(a) Explain how mitosis ensures that every cell of the tomato plants will contain the anti-freeze gene.

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.....

*(2 marks)*

(b) The tomato plants grown in this way will be clones.

Suggest reasons why people might object to this method of producing tomato plants.

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.....  
.....  
.....  
.....  
.....

*(3 marks)*

5

**11** Sickle-cell anaemia is a disorder of red blood cells. It is caused by a mutation in the haemoglobin gene.

(a) Explain, as fully as you can, how a mutation in this gene can cause a reduction in the oxygen-carrying capacity of the blood.

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.....  
.....  
.....  
.....  
.....

(3 marks)

(b) What is the probability that parents who are both carriers of the sickle-cell allele will produce a child with unaffected red blood cells?

Draw a genetic diagram to explain your answer, using **h** to represent the sickle-cell allele and **H** to represent the unaffected allele.

Probability of producing a child with unaffected red blood cells: .....

(4 marks)

Turn over ►



**BIOLOGY IN ACTION**

**12** The table shows the results of tests to determine the ABO blood group of two people.

The test is carried out by mixing samples of blood with solutions containing either antibody **a** or antibody **b**.

Person	Reaction with antibody a	Reaction with antibody b
<b>X</b>	Agglutination	Agglutination
<b>Y</b>	Agglutination	No reaction

(a) Explain what is meant by the term *agglutination*.

.....  
 .....  
 (1 mark)

(b) What is the blood group of person **X**? ..... (1 mark)

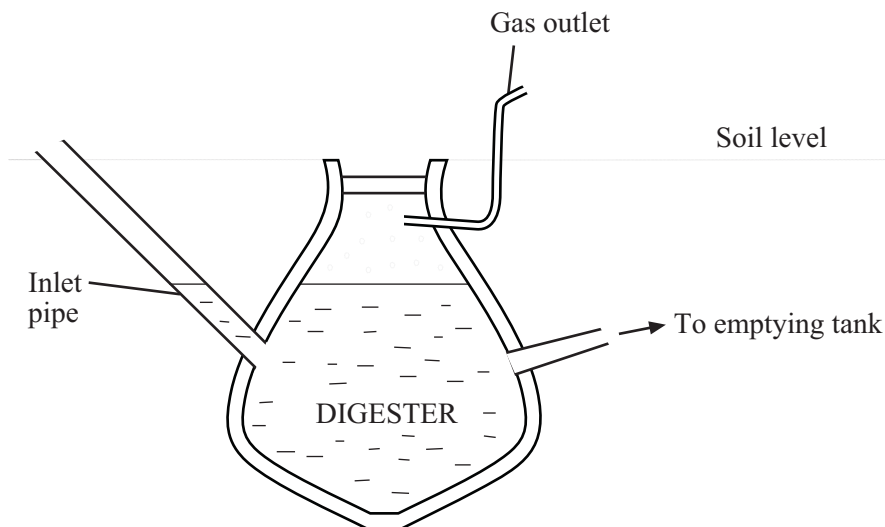
(c) What is the blood group of person **Y**? ..... (1 mark)

(d) Explain why the blood from person **X** agglutinates when mixed with antibody **a**.

.....  
 .....  
 .....  
 .....  
 .....  
 .....  
 .....  
 (3 marks)



13 The diagram shows a type of biogas generator often used on farms in developing countries.



(a) What type of raw material is usually put into the digester?

.....  
(1 mark)

(b) Name the gas produced in the fermentation process.

.....  
(1 mark)

(c) Suggest a reason why more gas is produced when the digester is underground.

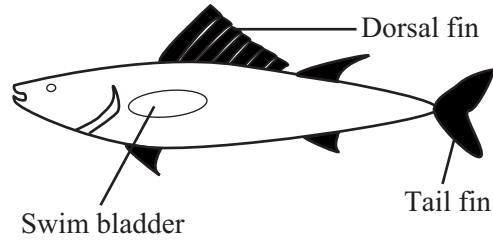
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.....  
(1 mark)

(d) Suggest **two** reasons why biogas generators are more likely to be found on farms in developing countries than on farms in Britain.

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.....  
.....  
.....  
(2 marks)

QUESTIONS RELATING TO PREVIOUSLY TESTED MODULES

14



(a) Complete the table to explain how each feature enables the fish to swim efficiently.

Feature	How the feature enables the fish to swim efficiently
Tail fin	
Body shape	
Dorsal fin	

(6 marks)

(b) Gas can be removed from the swim bladder.

Explain how this will change the position of the fish in the water.

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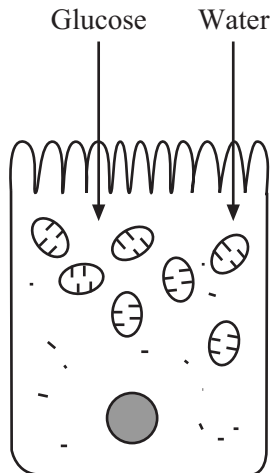
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(2 marks)

- 15 Dehydration, following diarrhoea, can be treated by giving the patient a dilute solution of sugars and salts.

The glucose in the mixture is taken up by active transport by the cells lining the small intestine. This allows the water to be absorbed by osmosis.

The diagram shows a cell from the lining of the small intestine.



Describe **two** ways in which the structure of this cell enables it to take up glucose and water rapidly.

1 .....

.....

2 .....

.....

(4 marks)

4

**END OF QUESTIONS**

**THERE ARE NO QUESTIONS PRINTED ON THIS PAGE**