Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4461/02

SCIENCE A/BIOLOGY

BIOLOGY 1
HIGHER TIER

A.M. WEDNESDAY, 8 January 2014

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**5**	
2.	**6**	
3.	**6**	
4.	**7**	
5.	**6**	
6.	**7**	
7.	**4**	
8.	**4**	
9.	**3**	
10.	**6**	
11.	**6**	
Total	**60**	

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ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

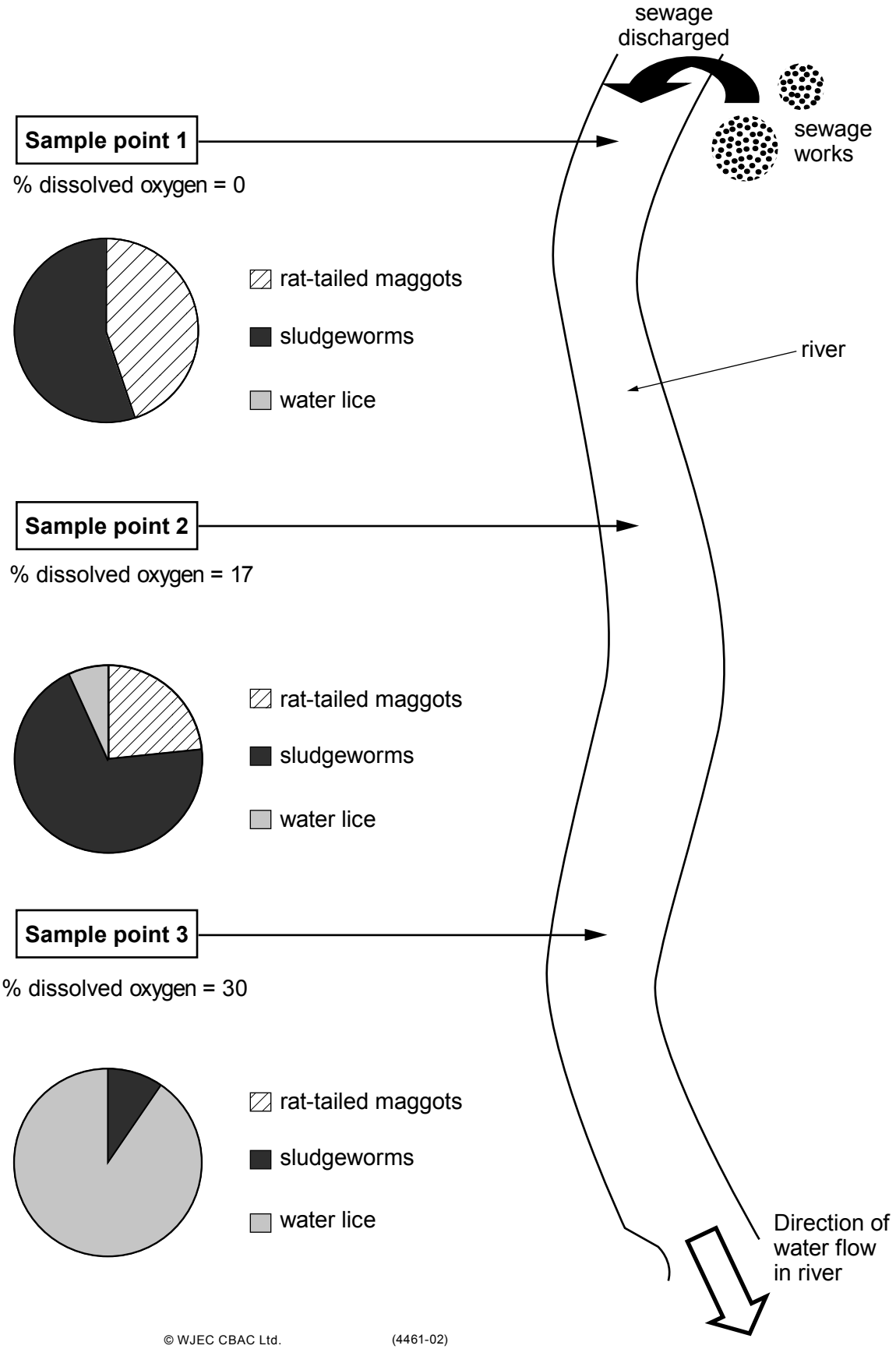
The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication used in your answer to questions **4** and **11**.

Answer **all** *questions.*

1. Recent flooding in the UK caused a sewage discharge into a river. Two weeks after the discharge the Environment Agency took samples of river water at 3 sample points 0.5 km apart.

The percentage (%) of dissolved oxygen in the sample was measured and the animals in the samples were counted and the data plotted as pie charts. The results are shown below.



Examiner only

Use the information from the diagram opposite to answer the following questions.

(a) The presence of which **two** animals in the samples indicates **high** levels of water pollution? [2]

....

(b) Which animal cannot live in highly polluted water? [1]

.....

(c) (i) What happens to the percentage of dissolved oxygen as the water flows downstream? [1]

.....

(ii) Rat-tailed maggots need oxygen to live. Suggest how they can live at **Sample point 1** where there is no oxygen dissolved in the water. [1]

.....

.....

5

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Turn over.

Examiner only

2. Anna has been a diabetic for 6 months. She injects herself with insulin before meals in order to control the level of glucose in her blood. Like all diabetics who have not been injecting insulin for very long she finds it difficult to get the dose correct.
Before every meal Anna carries out the following procedure.

1. Measures the concentration of glucose in her blood.

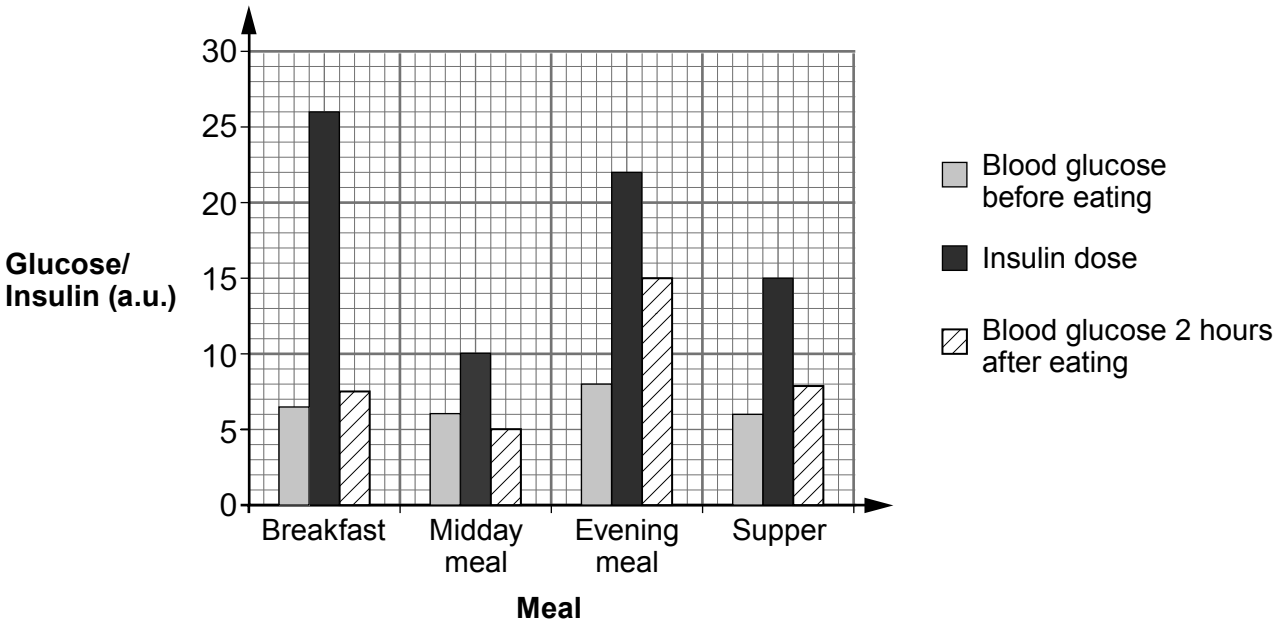
2. Estimates whether the meal she is about to eat has a high, medium or low level of glucose (sugar) in it.

3. Inject insulin, the dose of which depends on the level of glucose in the meal.

Two hours after the meal she measures the concentration of glucose in her blood again.

Anna records all this information on an App, called ***Glucose Buddy***, on her iPhone.

The chart below shows Anna's complete record for one day on ***Glucose Buddy***.



Examiner only

(a) (i) Which meal of the day did Anna estimate contained the lowest level of glucose? Give a reason for your answer. [2]

Meal .....

Reason .....

.....

(ii) Anna tries to keep her blood glucose level below 8 a.u. Using only the chart and the information opposite suggest reasons why her blood glucose level was still 15 a.u. two hours after she ate her evening meal. [2]

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(b) How does insulin lower the level of glucose in the blood? [2]

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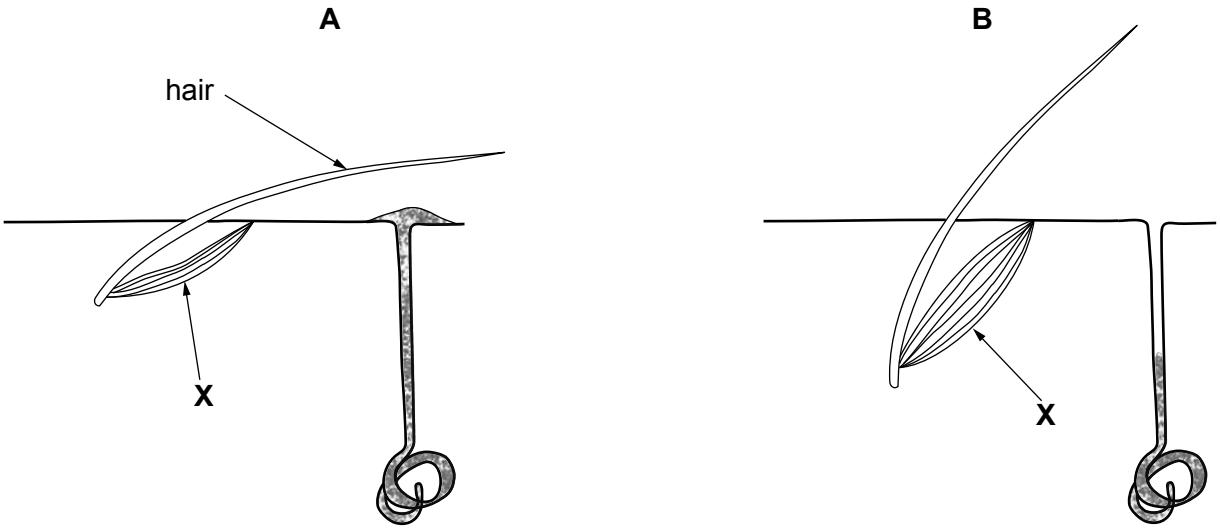
6

Turn over.

Examiner only

3. Diagrams **A** and **B** below show the skin under two different environmental conditions.



(a) (i) Which of the diagrams shows the skin in hot conditions? ..... [1]

(ii) Give **two** reasons for your answer. [2]

I. .....

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II. .....

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(b) If blood vessels had been drawn on the diagrams, the blood vessels in the skin in diagram **B** would be narrower than in diagram **A**. Explain how this helps to control body temperature. [2]

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(c) State how structure **X** on the diagrams above causes the hair to appear as it does in diagram **B**. [1]

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Examiner only

4. In 1960, a survey of a large pond on a farm found that it contained a rich variety of aquatic insects, snails and four different fish species.

In 1965, the farmer started growing cereal crops on his land. Pellets containing nitrate were spread on the crops several times a year. By 1975, the pond had become overgrown with algae and other aquatic plants and a new survey found that there were very few aquatic insects and no fish species.

Pellets containing nitrate

(a) State why the farmer spread nitrate on the cereal crops. [1]

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(b) Use the information above and your own knowledge to explain the changes which occurred to the pond. [6 QWC]

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(lines continued overleaf)

Turn over.

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Examiner only

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7

Examiner only

5. Mrs Hughes is a well known breeder of both yellow and black Labrador dogs. The allele for black coat (**B**) is dominant to the allele for yellow coat (**b**). Mrs Hughes finds it easier to sell black Labrador puppies because they are more popular. She does however produce yellow Labrador puppies when there is a demand for them.

Mrs Hughes has recently bought a black Labrador dog because it has many of the features which judges look for in dog shows, but she does not know its genotype.

(a) State the meaning of the term *genotype*. [1]

.....

.....

(b) (i) Mrs Hughes wants to breed from the black Labrador she has just bought but needs to know its genotype. How could she find out its genotype? Give a full explanation of the cross she could carry out and the expected results. [3]

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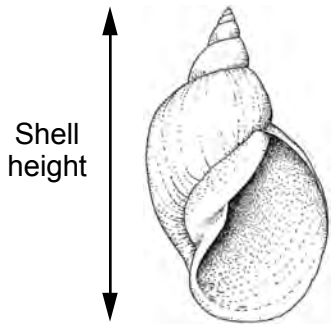
(ii) Complete the Punnett squares below to show the **possible** results of this cross. [2]

Gametes		

Gametes		

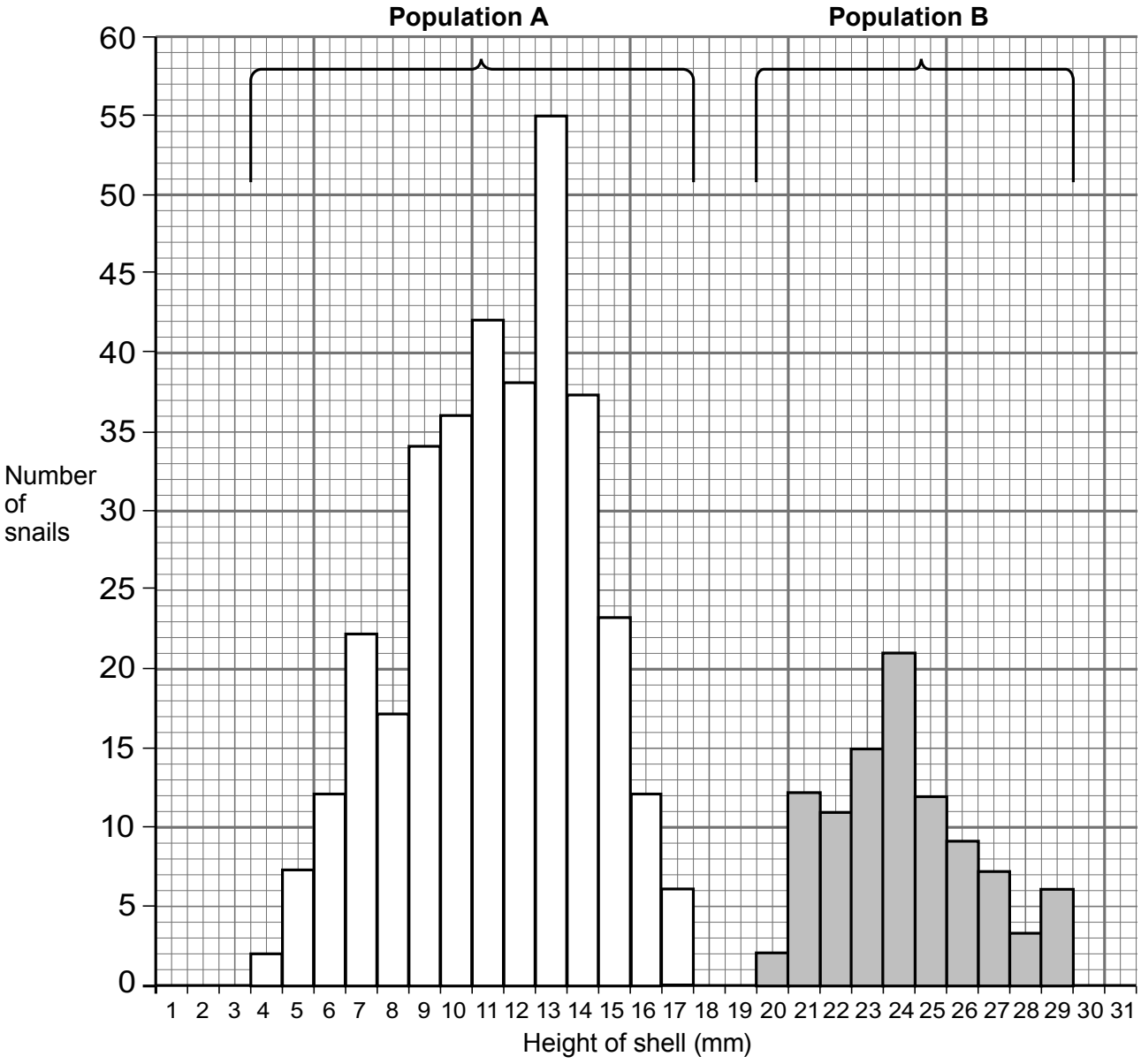
6

6. The heights of the shells of two separate populations of the pond snail, *Lymnaea stagnalis*, were measured in an investigation into variation.



Lymnaea stagnalis

The bar charts below show the results for the two populations, labelled population **A** and population **B**.



(a) (i) Populations **A** and **B** show the same type of variation. Name the type of variation. [1]

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Examiner only

(ii) What evidence is shown in the bar charts to suggest that population **B** is older than population **A**? [1]

.....

(iii) What are the **two** least common shell heights in population **A**? [1]

..... and .....

(iv) Calculate the difference in the **maximum** shell height between population **A** and population **B**. [1]

.....

(b) Suggest **three** environmental factors that could account for the variation shown in the separate populations. [3]

I. .....

II. .....

III. .....

7

7. The owner of a garden centre wanted to know whether young strawberry plants in two boxes **X** and **Y** had been grown from seeds or had been grown asexually. He allowed them to grow to maturity in identical conditions.

Plants from box **X** produced identical flowers, all at the same time.
Plants from box **Y** produced flowers which varied in shape and size, some of which were produced earlier than others.

(a) State why plants from box **X** could be described as *clones*. [1]

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(b) (i) Explain how sexual reproduction results in the variation seen in the plants in box **Y**. [2]

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(ii) Give **one** advantage to the species of variation produced by sexual reproduction. [1]

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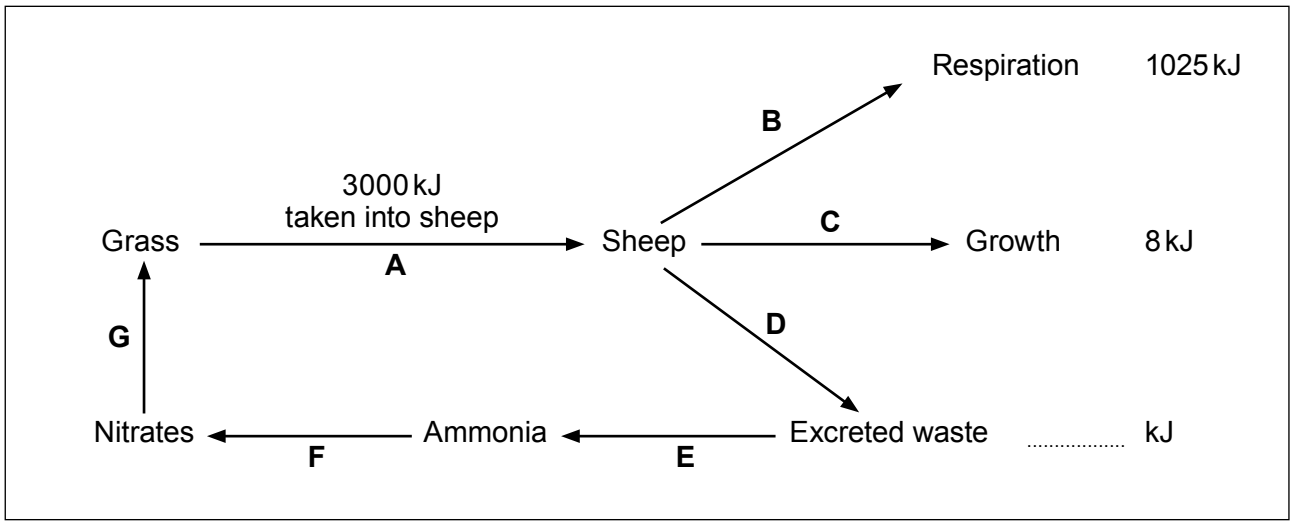
4

Turn over.

Examiner only

8. The following flow chart shows part of the nitrogen cycle. It also shows the energy relationships between some organisms and their environment.



(a) (i) Complete the flowchart above to show how much energy is in the excreted waste. [1]

(ii) Calculate the percentage of the energy taken into the sheep which is used in growth. Show your method in the space below. [1]

Answer ..... %

(b) Use the flow chart above to state

(i) the letter which represents the action of urease ..... [1]

(ii) a letter which represents protein production ..... [1]

4

Examiner only

9.

Leeches help in hunt for rare species

Leeches feed on the blood of mammals. Leeches can keep blood cells in their digestive systems for four months.
It was suspected that several endangered species of mammals existed on an island. These mammals had not been seen on the island for 25 years, but their genetic profiles had been stored in laboratories.

Explain how scientists could use leeches, collected on the island, and the technique of genetic profiling to prove that the endangered species of mammals still exist. [3]

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3

Turn over.

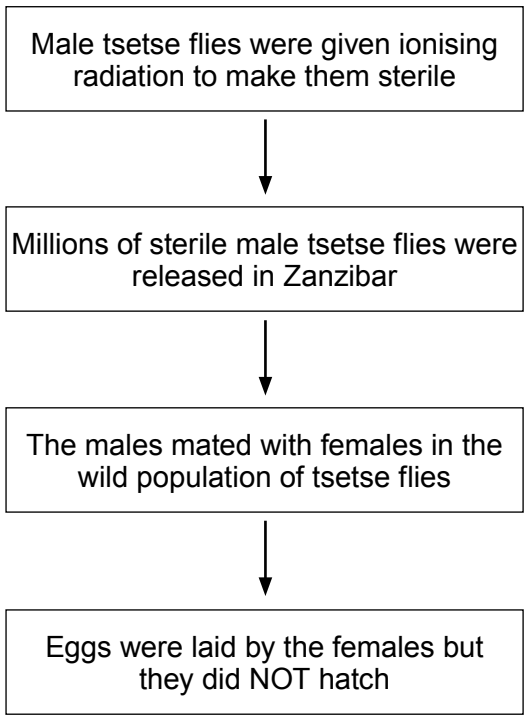
Examiner only

10. The photograph below shows a male tsetse fly *(Glossina palpalis)*.

© Ray Wilson/Alamy

- The tsetse fly *Glossina palpalis* is a pest.
- One method of pest control relies on releasing sterile male insects (insects which cannot produce sex cells) into wild populations.
- Sterile male tsetse flies have been used in pest control in this way, in a successful attempt at controlling the tsetse fly population in Zanzibar.
- Zanzibar is a small island off the coast of the continent of Africa.

The principle of this method of pest control is as follows:



(a) State how ionising radiation caused the tsetse flies to become sterile. [1]

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Examiner only

(b) State **three** disadvantages of using insecticides compared to the method of pest control described opposite. [3]

I. .....

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II. .....

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III. .....

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(c) Suggest why the use of sterile male tsetse flies as a method of pest control is more likely to be successful on the small island of Zanzibar than it would be on the mainland of Africa. [2]

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6

Turn over.

Examiner only

11. A bacterial gene which gives resistance to herbicides and can increase photosynthesis has been transferred into soya plants. A field of these genetically modified (G.M.) soya plants was sprayed with herbicide.

Explain fully the expected effects on the yield of soya beans. [6 QWC]

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6

END OF PAPER