Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

3072262023

BIOLOGY **0610/31**

Paper 3 Extended **May/June 2014**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **18** printed pages and **2** blank pages.

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1 Some information about pollutants, their sources and their effects on the environment are shown in Table 1.1.

Table 1.1

pollutant	source	effect on the environment
heavy metals in chemical waste		disrupts functioning of plants, causes brain damage
phosphate		eutrophication of streams, rivers and lakes
sulfur dioxide		damage to trees, e.g. death of leaves
ionising radiation		
DDT	pesticide sprays	accumulates in tissues of animals

(a) Complete Table 1.1. [5]

(b) Explain what happens in streams, lakes and rivers when eutrophication occurs.

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.....[5]

(c) Sulfur dioxide dissolves in rain water to form acid rain.

Describe **two** measures that can be taken to reduce the effects of acid rain.

1 .....

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2 .....

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[2]

[Total: 12]

2 Dairy cattle are kept for milk production. Approximately half of all the calves born are male.

(a) Sex is determined in cattle in exactly the same way as it is in humans.

Explain why 50% of all cattle are born male.

You may draw a genetic diagram to help your explanation.

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.....[4]

(b) Dairy farmers only need a very small number of male calves. They limit the number by using sex selection. Sperm cells are identified and sorted before they are used in artificial insemination (AI).

Explain how artificial insemination is carried out.

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.....[2]

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(c) Table 2.1 shows the composition of 100 g of cow's milk compared with the same quantities of commercial formula milk and human milk.

Table 2.1

nutrient	cow's milk	formula milk	human milk
carbohydrate / g	6.5	7.3	7.5
protein / g	3.3	1.3	1.3 – 1.6
fat / g	3.9	3.6	4.1
calcium / mg	120	42	34
iron / mg	0.02	0.64	0.07
vitamin D / µg	0.05	1.20	0.06
vitamin A / µg	19	66	58

Some women do not breast-feed their babies but bottle-feed them using formula milk. Health authorities advise against the use of cow's milk until babies are about 9 months old.

Use the information in Table 2.1 to explain the advantages of using formula milk rather than cow's milk.

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.....[4]

One of the components of human milk is the enzyme lysozyme that is present in many body fluids and is responsible for breaking down the cell walls of bacteria.

(d) Define the term *enzyme*.

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.....[2]

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[Turn over

(e) The effect of human lysozyme on two common species of bacteria, **A** and **B**, was investigated at two different values of pH.

The investigation was set up as shown in Fig. 2.1.

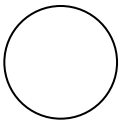
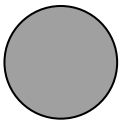
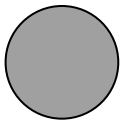
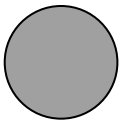
The test-tubes were kept at 37 °C for 24 hours.

tube number	1	2	3	4
species of bacteria	A	A	A	B
pH of medium	4.0	4.0	9.0	4.0
fresh lysozyme	✓		✓	✓
boiled lysozyme		✓		

Fig. 2.1

After 24 hours, samples were taken from each test-tube. Each sample was placed onto nutrient agar in Petri dishes. The dishes were incubated at 28 °C for a further 24 hours to allow any bacteria to grow.

The results are shown in Fig. 2.2.

sample from test-tube	1	2	3	4
result after incubation for 24 hours				

Key:

 no growth of bacteria

 growth of bacteria

Fig. 2.2

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Explain the results shown in Fig. 2.2 by comparing the following pairs:

1 and **3** .....

.....

.....

.....[2]

1 and **4** .....

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.....

.....[2]

1 and **2** .....

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.....[2]

(f) Human milk also contains antibodies. Explain the benefits of antibodies to a newborn child.

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.....[2]

[Total: 20]

3 Fig. 3.1 is a diagram that shows the control of blood glucose concentration.

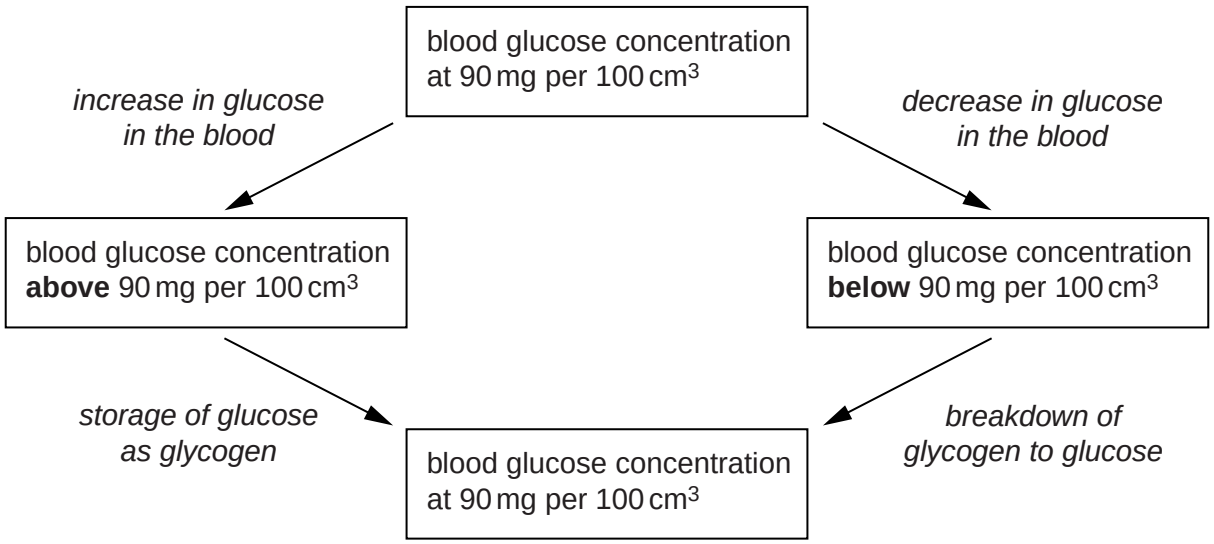


Fig. 3.1

(a) (i) State **one** reason why the concentration of glucose in the blood **increases**.

.....

.....[1]

(ii) State **one** reason why the concentration of glucose in the blood **decreases**.

.....

.....[1]

(iii) Name **two** places in the body where glycogen is stored.

1 .....

2 .....

[2]

(b) Explain how an increase in glucose concentration is controlled in the body.

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.....[3]

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(c) If the blood glucose concentration is very high there is a decrease in the water potential of the blood. This may damage the red blood cells.

Explain how a decrease in water potential of the blood may damage red blood cells.

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.....[3]

[Total: 10]

4 **(a)** Define the term *respiration*.

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.....[2]

(b) A rowing machine is a piece of apparatus that is used in many fitness centres.

Fig. 4.1 shows a man training on a rowing machine. The man in the photograph has his arms extended during the rowing stroke as shown in Fig. 4.2.

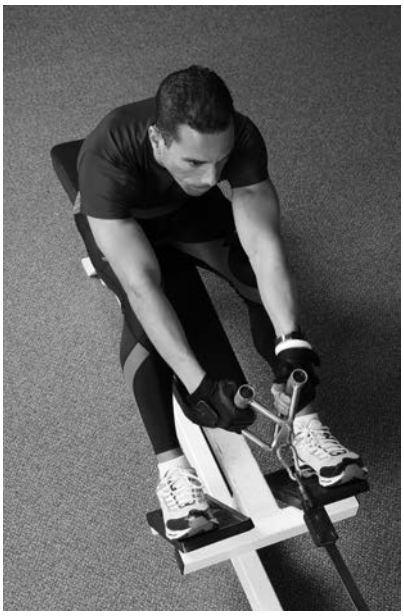


Fig. 4.1

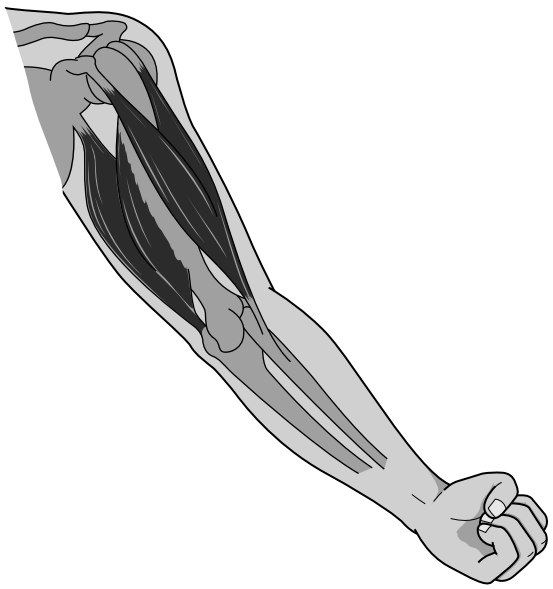


Fig. 4.2

Use Fig. 4.2 to describe how the hand is moved closer to the chest during the rowing stroke.

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.....[3]

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(c) The man has an intense workout on the rowing machine.

Fig. 4.3 shows his oxygen uptake before and during the exercise.

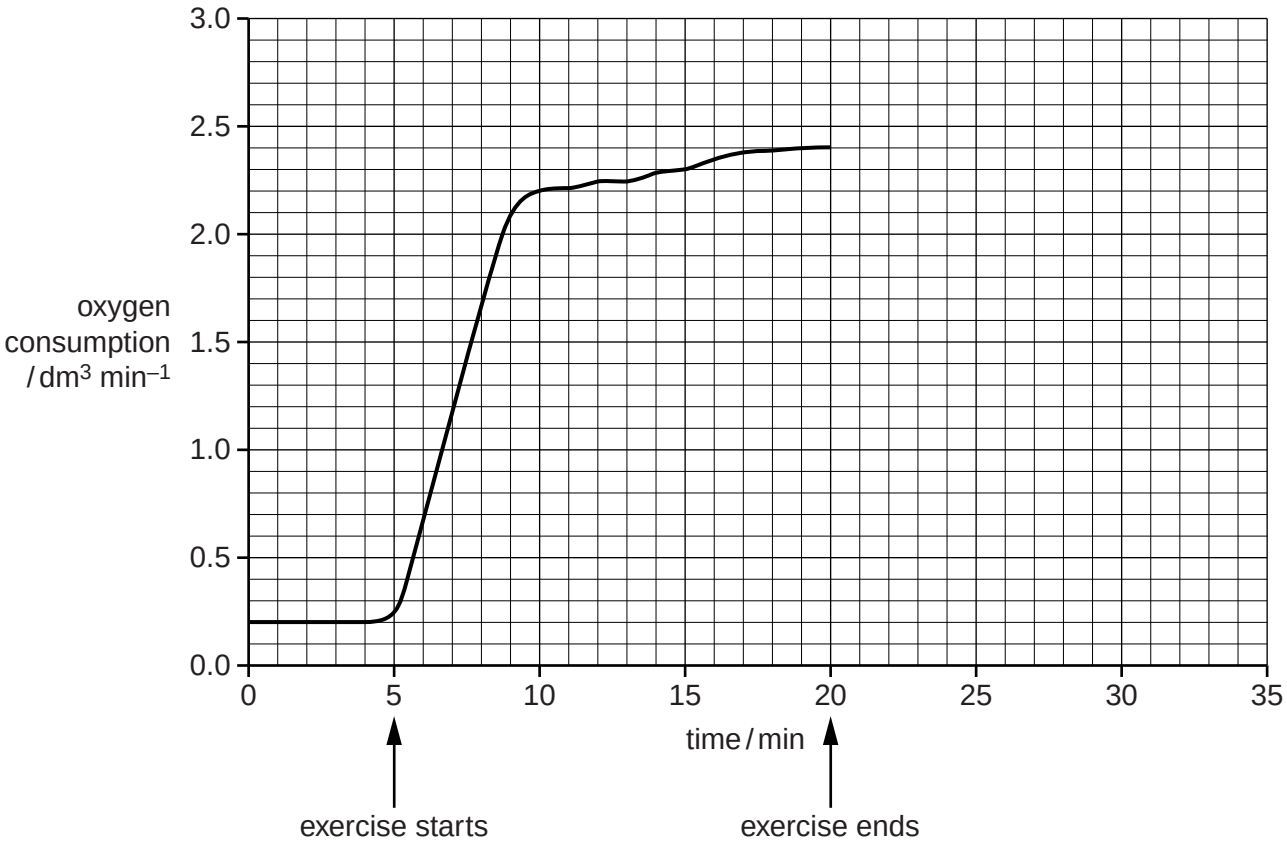


Fig. 4.3

(i) Explain why there is a steep increase in the man's oxygen consumption at the start of the exercise.

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.....[4]

(ii) It took 10 minutes after the man had stopped rowing for his oxygen consumption to decrease to its resting value.

On Fig. 4.3 draw a line between 20 minutes and 35 minutes to show the change in oxygen consumption after exercise has stopped. [2]

(iii) Explain why the man's oxygen consumption did not return to the resting value **immediately** after exercise.

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.....[4]

[Total: 15]

5 Fig. 5.1 shows the nematode, *Caenorhabditis elegans*.



Fig. 5.1

(a) (i) State the genus of this nematode.

.....[1]

(ii) State two **structural** features of nematodes.

1 .....

2 .....
[2]

(b) Nematodes feed on dead and decaying material. Explain why this gives nematodes an important role in ecosystems.

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.....[3]

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(c) Fig. 5.2 shows the life cycle of *C. elegans*. The diploid number of this species is 12.

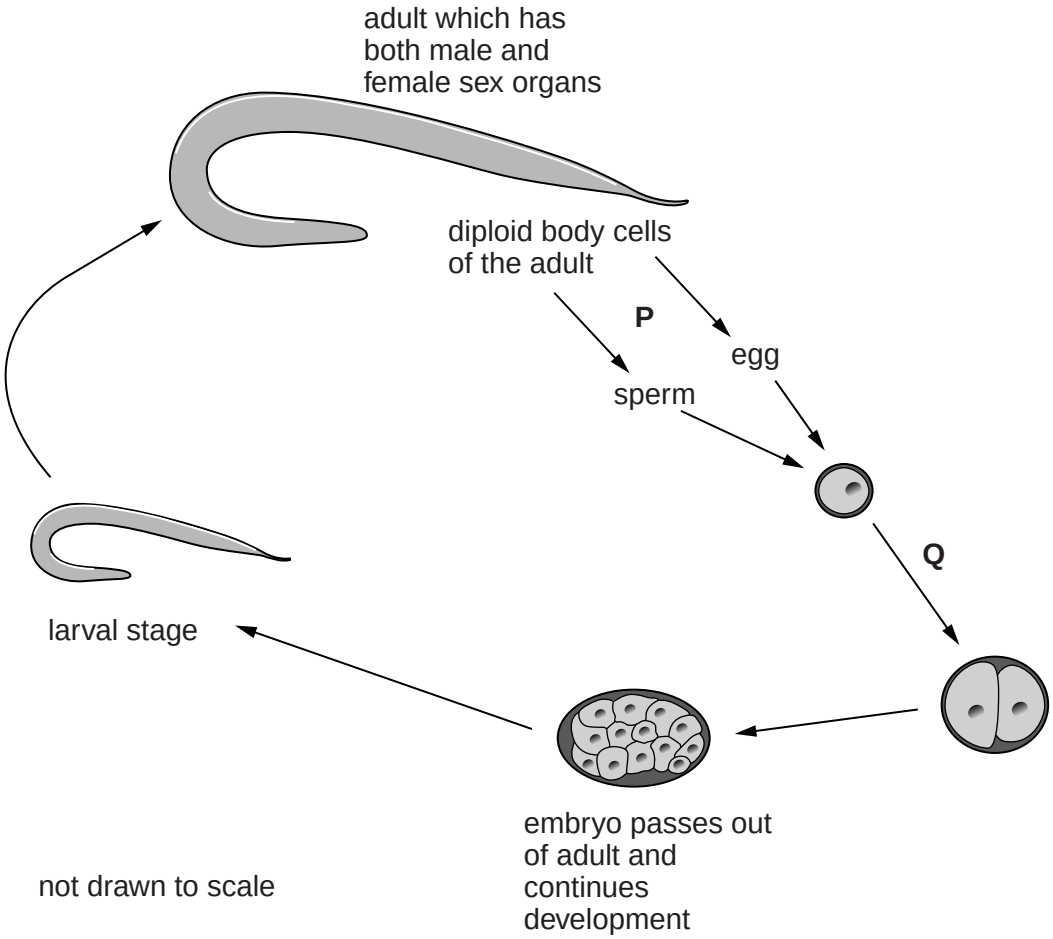


Fig. 5.2

(i) Suggest why there is very little genetic variation in the offspring of the adult nematode shown in Fig. 5.2.

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.....

.....[2]

(ii) State the haploid number of *C. elegans*.

.....[1]

(iii) Explain why **meiosis** occurs at **P** and **mitosis** occurs at **Q**.

meiosis at **P**.....

.....

.....

.....

mitosis at **Q** .....

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.....

.....[3]

(d) *C. elegans* was one of the first organisms to have its genome sequenced.

An organism's genome is the sum of all its genetic material. Gene sequencing identifies all the component parts of the DNA that makes up the genome.

State where DNA is located in a cell.

.....

.....[2]

[Total: 14]

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6 The pea plant, *Pisum sativum*, is a legume which is grown both as a human food and as livestock feed.

Fig. 6.1 shows some of the root nodules on a pea plant.

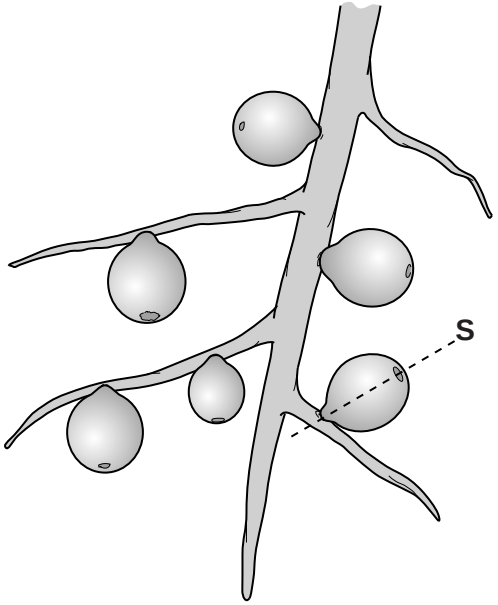


Fig. 6.1

Fig. 6.2 shows a cross-section through the root nodule at **S** on Fig. 6.1.

T indicates the transport tissue in the root.

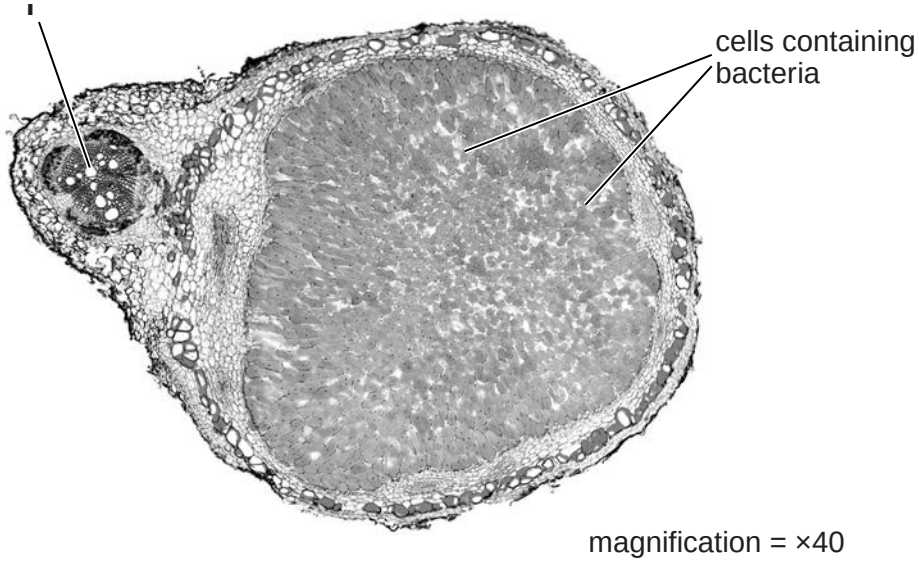


Fig. 6.2

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(a) The maximum diameter of the root nodule in Fig. 6.2 is 73 mm.

Calculate the actual diameter of the root nodule.

actual diameter ..... [1]

(b) Describe the role of the bacteria in the root nodules of *P. sativum*.

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.....[2]

(c) The bacteria require carbohydrates that are supplied by the pea plant.

Describe how the carbohydrates are produced and transported by the plant to the bacteria.

(i) produced

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.....[2]

(ii) transported

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.....[2]

(d) Pea plants grow well in soils that are deficient in nitrogen.

Explain how root hair cells of pea plants absorb nitrate ions from soils with low nitrate concentrations.

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.....[2]

[Total: 9]

Copyright Acknowledgments:

Question 4 Figure 4.1 © Ref: 8267369; leezsnow; *Workout on Rowing Machine From Above*; www.istockphoto.com.
Question 5 Figure 5.1 © Ref: Z180/0117; SINCLAIR STAMMERS/SCIENCE PHOTO LIBRARY; *LM of the nematode worm, Caenorhabditis elegans*; www.sciencephoto.com.
Question 6 Figure 6.2 © Ref: C003/5896; DR KEITH WHEELER/SCIENCE PHOTO LIBRARY; *Nitrogen-fixing root nodule, micrograph*; www.sciencephoto.com.

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