

CANDIDATE
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BIOLOGY (US)

0438/31

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 Center 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.

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

(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

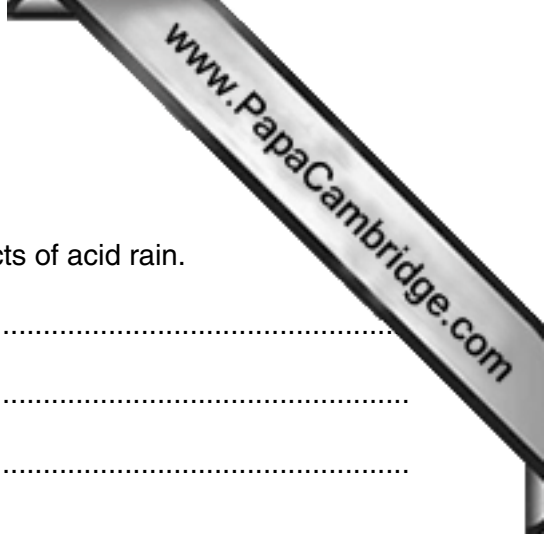
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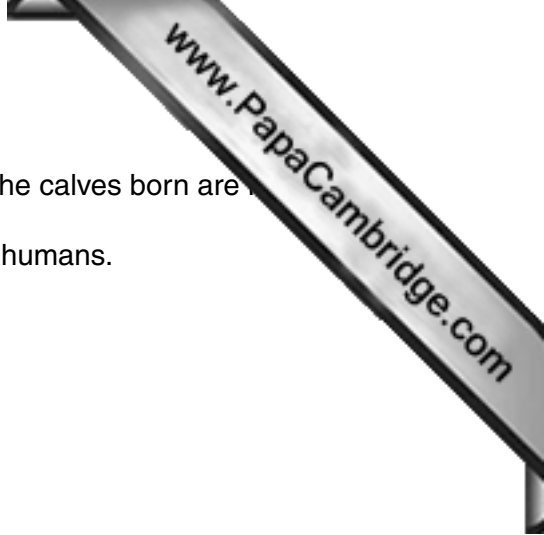
2

.....

[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.

.....

.....

.....

.....

.....

.....[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.

.....

.....

.....

.....

.....

.....[2]

- (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.

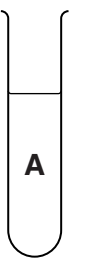
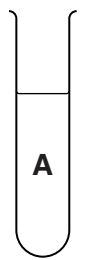
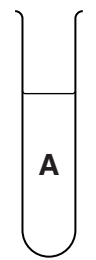
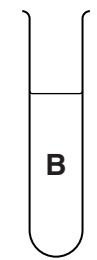
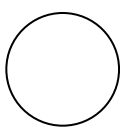
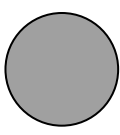
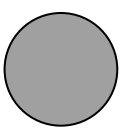
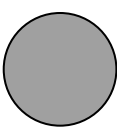
tube number	1	2	3	4
species of bacteria				
pH of medium	4.0	4.0	9.0	4.0
fresh lysozyme	✓		✓	✓
boiled lysozyme		✓		

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:



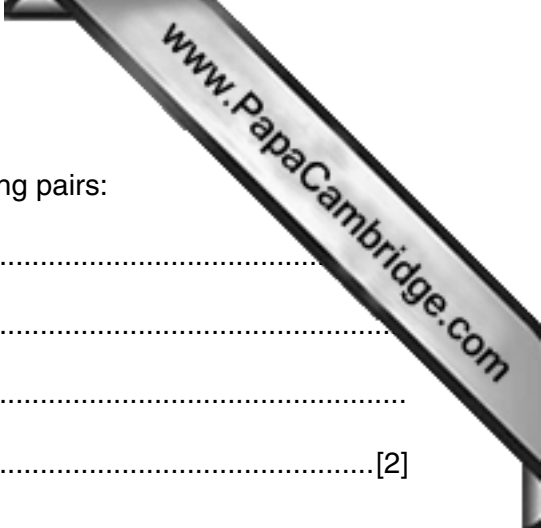
-  no growth of bacteria
 growth of bacteria

Fig. 2.2



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

1 and 3
.....
.....
..... [2]

1 and 4
.....
.....
..... [2]

1 and 2
.....
.....
..... [2]

(f) Human milk also contains antibodies. Explain the benefits of antibodies to a newborn child.
.....
.....
.....
.....
..... [2]

[Total: 20]

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

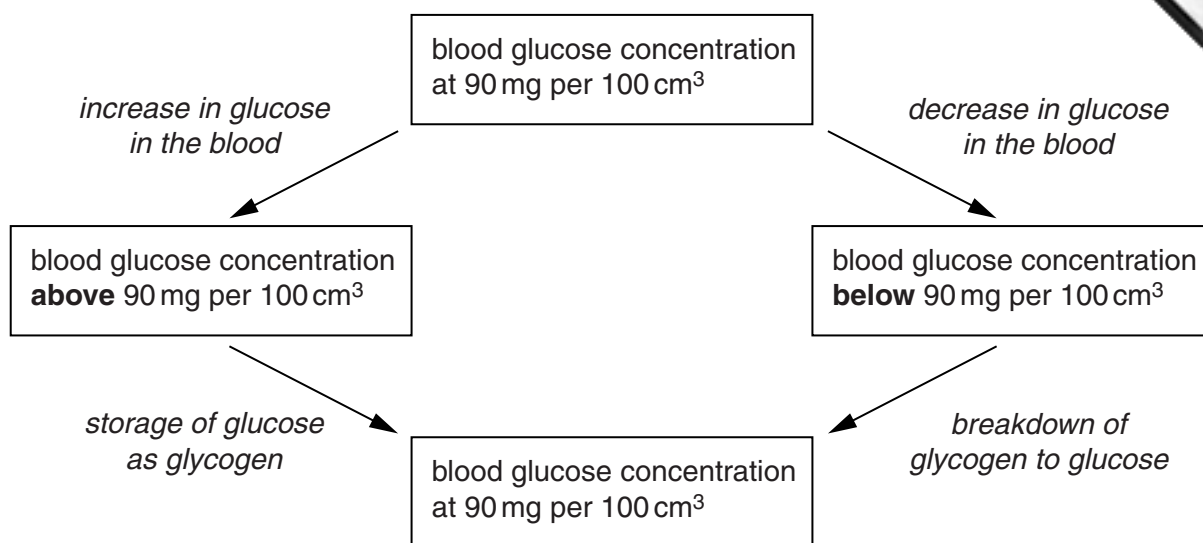


Fig. 3.1

(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.

.....

[3]

11
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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.

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

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

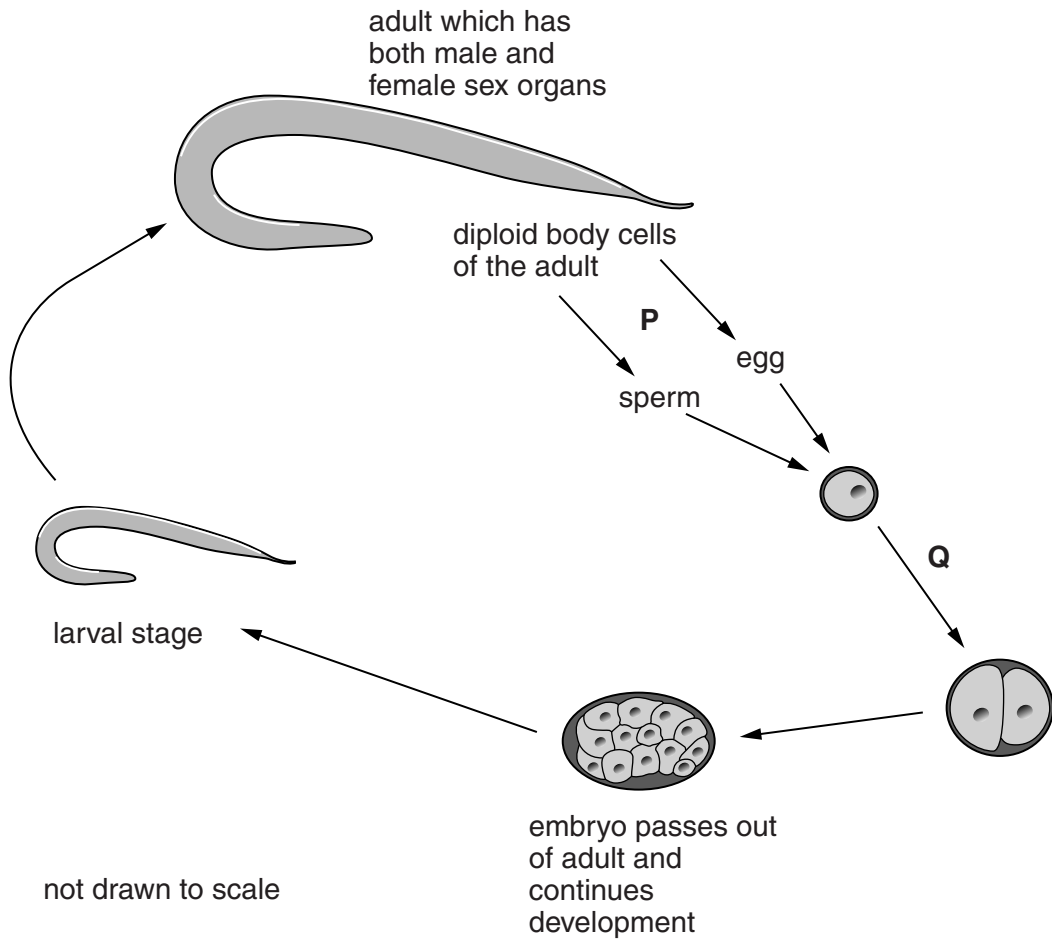


Fig. 5.2

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

.....

.....

.....

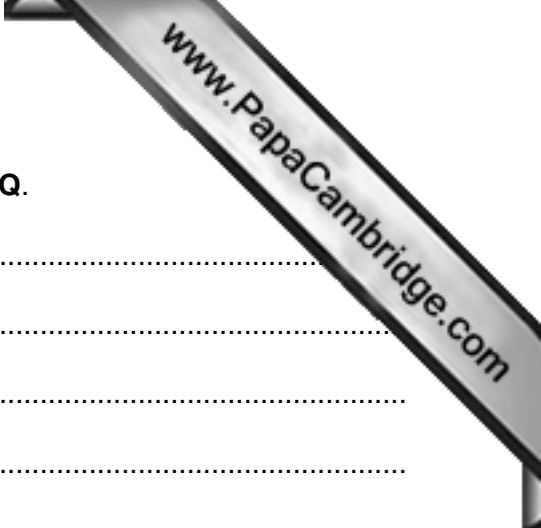
.....

.....

.....[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**.....

[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]

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

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

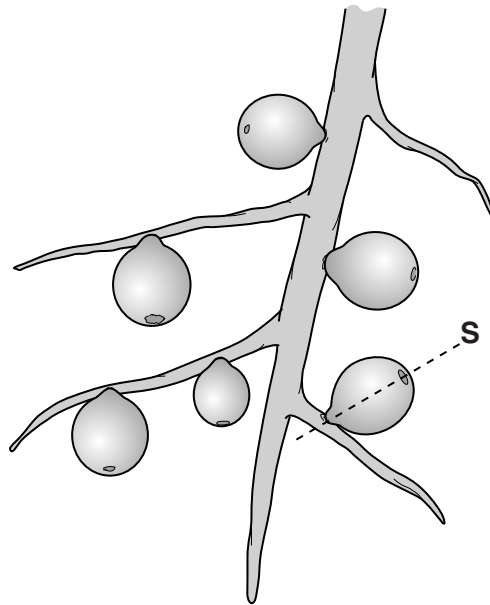


Fig. 6.1

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.

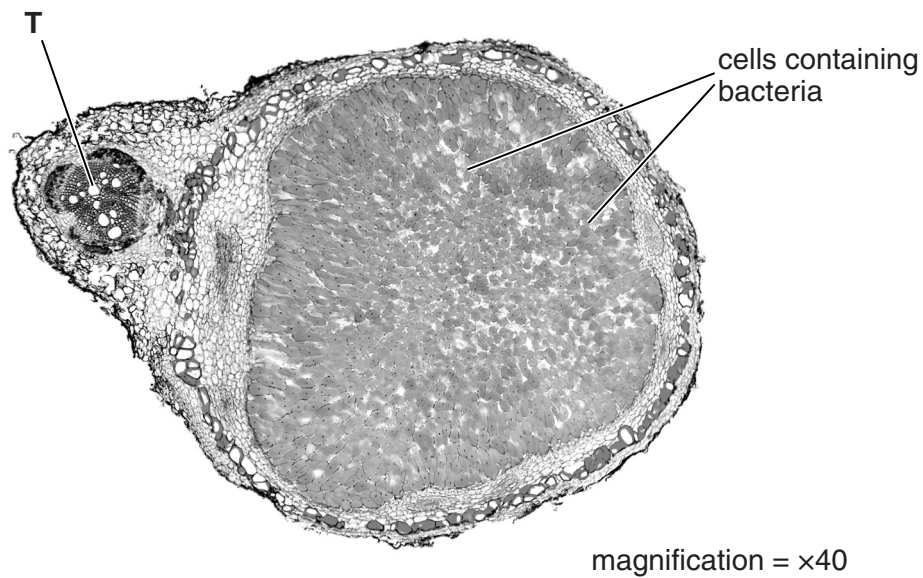
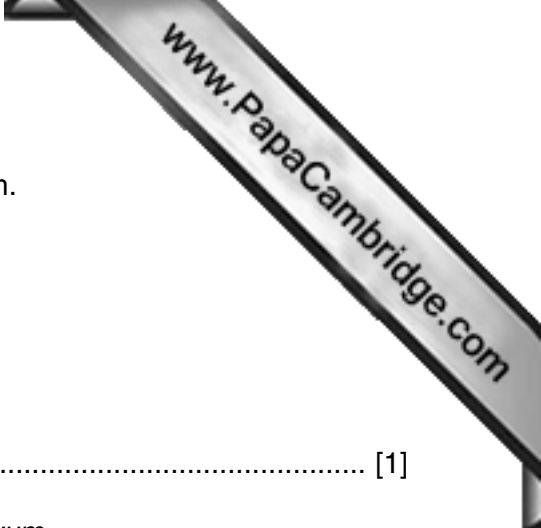


Fig. 6.2



(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*.

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

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

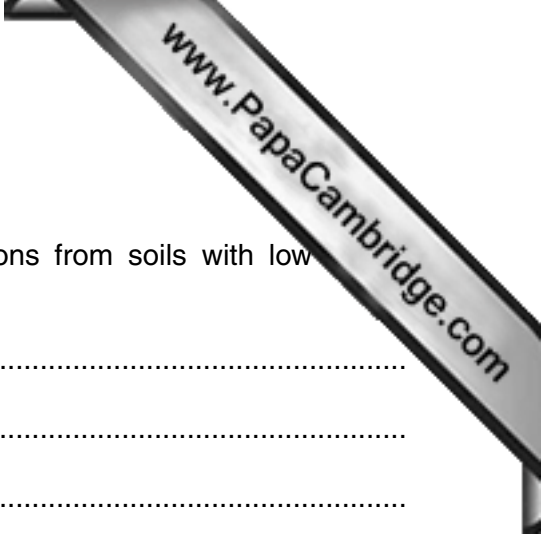
Describe how the carbohydrates are produced and transported by the plant to the bacteria.

(i) produced

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

(ii) transported

.....
.....
.....
..... [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 concentrations.

.....

.....

.....

.....

.....[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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