



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
International General Certificate of Secondary Education

CANDIDATE  
NAME

CENTRE  
NUMBER

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CANDIDATE  
NUMBER

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**BIOLOGY**

**0610/31**

Paper 3 Extended

**October/November 2009**

**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 a pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, glue or correction fluid.

**DO NOT WRITE IN ANY BARCODES.**

Answer **all** questions.

At the end of the examination, fasten all your work securely together.

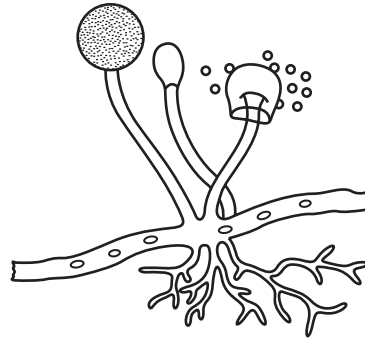
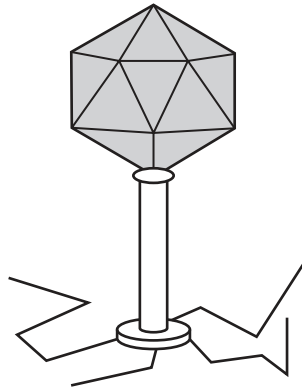
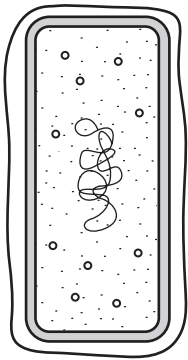
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
<b>1</b>	
<b>2</b>	
<b>3</b>	
<b>4</b>	
<b>5</b>	
<b>6</b>	
<b>Total</b>	

This document consists of **17** printed pages and **3** blank pages.



1 Fig. 1.1 shows a bacterium, a virus and a fungus.



not to scale

Fig. 1.1

(a) Complete the table to compare the three organisms shown in Fig. 1.1 by using a tick (✓) to indicate if the organism shows the feature, or a cross (X) if it does not. The first row has been completed for you.

feature	bacterium	virus	fungus
produces spores	X	X	✓
hyphae			
capsule			
nucleus			

[3]

(b) Explain how the fungus shown in Fig. 1.1 is adapted to obtain its food.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[3]

(c) Explain how the fungus spreads to new sources of food.

.....

.....

.....

..... [2]

[Total: 8]

*For  
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Use*

2 Fig. 2.1 shows a villus from the small intestine of a mammal and an enlarged view of a cell from region **A**.

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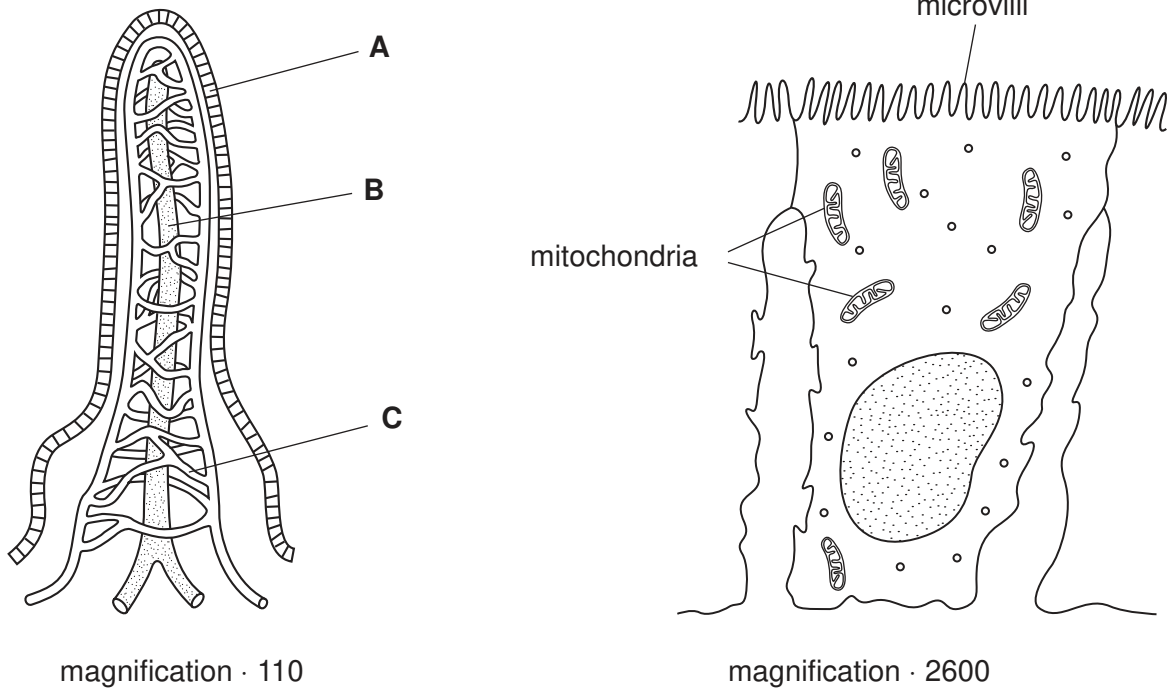


Fig. 2.1

(a) Name regions **A**, **B** and **C**.

**A** .....

**B** .....

**C** ..... [3]

(b) Explain why the cells from region **A** have many microvilli and mitochondria.

*many microvilli* .....

.....

.....

*many mitochondria* .....

.....

..... [4]

(c) The Food Standards Agency in the UK defines a food additive as:

‘any substance intentionally added to food for a specific function that is not normally eaten as a food or used as a characteristic ingredient in food.’

Some additives are naturally occurring substances, but others are man-made. Some additives have been identified as a risk to people’s health.

(i) State two benefits of using food additives in processed foods.

- 1. ....  
.....
  - 2. ....  
.....
- [2]

(ii) State **four** possible risks to health that have been linked to food additives.

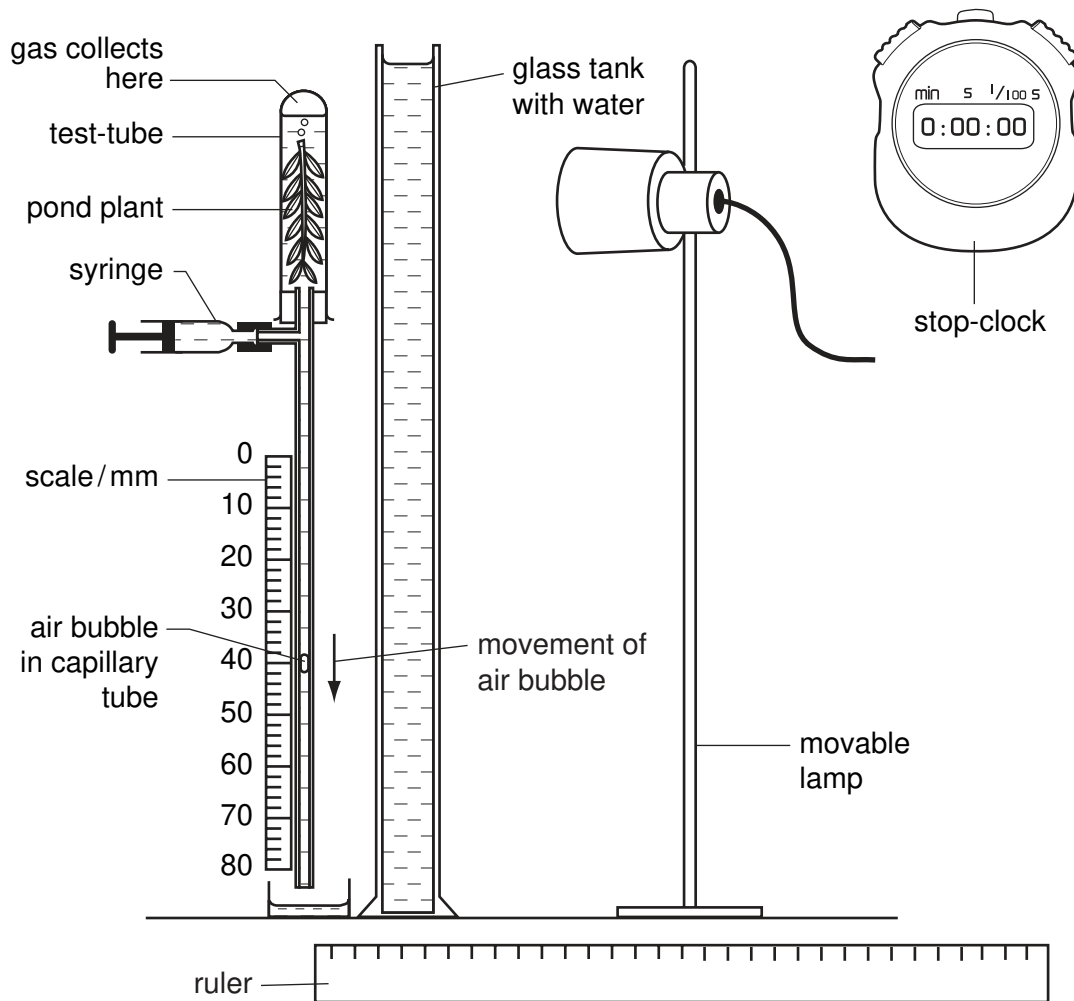
- .....
  - .....
  - .....
  - .....
  - .....
  - .....
  - .....
- [4]

[Total: 13]

For  
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- 3 A student set up the apparatus shown in Fig. 3.1 to investigate the effect of light intensity on the rate of photosynthesis of a pond plant.

For  
Examiner's  
Use



**Fig. 3.1**

The student maintained the temperature at 20 °C and measured the distance travelled by the air bubble in the capillary tube for a period of five minutes on three occasions for each light intensity.

The student's results are shown in Table 3.1 on page 8.

(a) (i) Explain why the student included the glass tank and the syringe in the apparatus.

For  
Examiner's  
Use

*glass tank* .....

.....

*syringe* .....

..... [2]

(ii) Explain why the air bubble moves down the capillary tube.

.....

.....

.....

.....

.....

..... [3]

Table 3.1

distance of lamp from pond plant / mm	distance travelled by air bubble / mm	rate of photosynthesis / mm per minute
20	30	6.0
30	26	5.2
40	14	2.8
50	7	
60	3	0.6

For  
Examiner's  
Use

- (b) (i) Calculate the rate of photosynthesis when the lamp was 50 mm from the pond plant and write your answer in the table. [1]

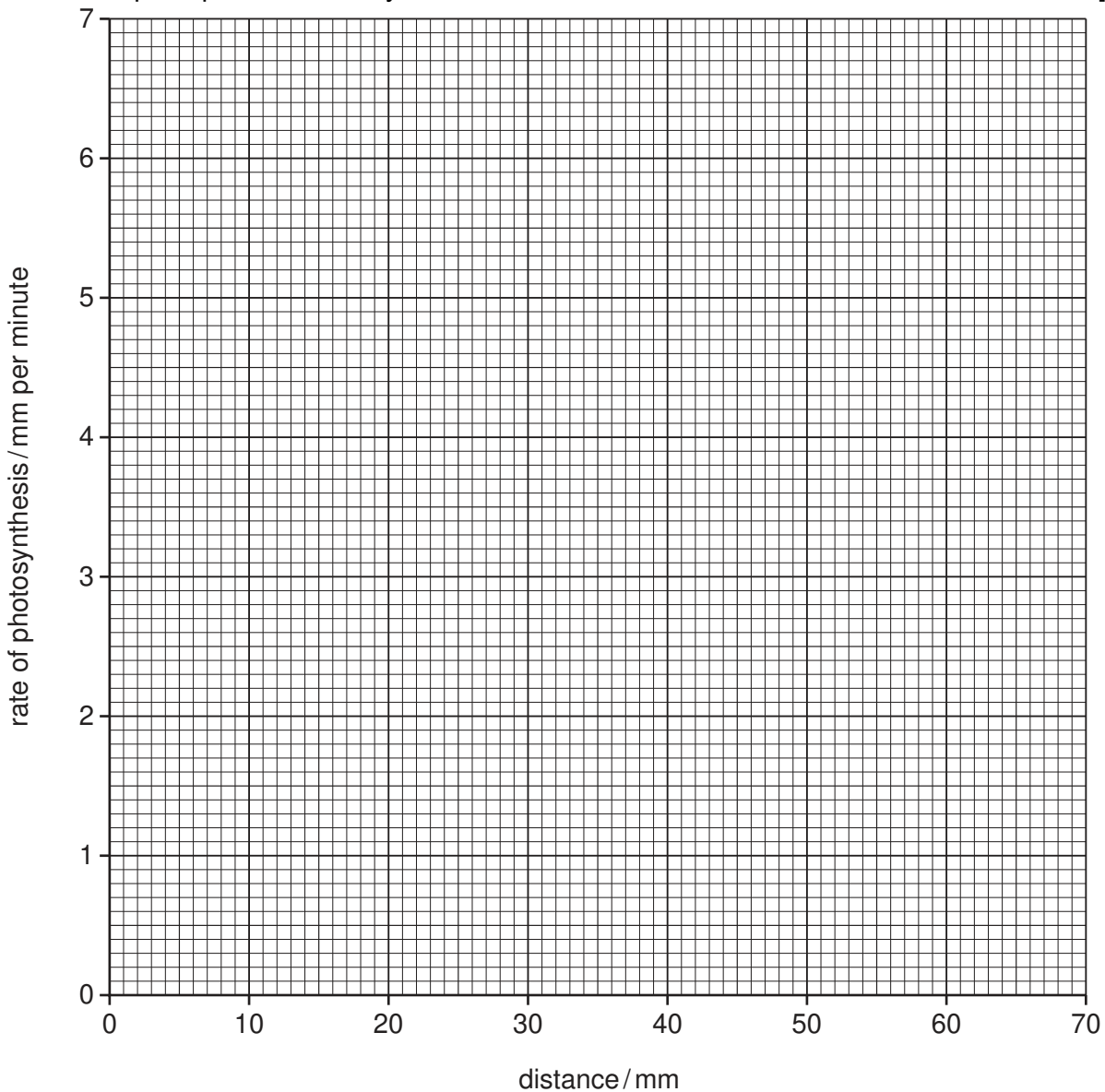


Fig. 3.2



(ii) Plot the student's results from Table 3.1 on the axes on Fig. 3.2.  
Draw an appropriate line on the graph to show the relationship between  
distance of the lamp from the pond plant and the rate of photosynthesis. [2]

(c) (i) Using the graph to help you, predict the results that the student would get if the  
lamp was positioned 15 mm and 70 mm from the pond plant.

15 mm ..... mm per minute  
70 mm ..... mm per minute [2]

(ii) Explain why the rate of photosynthesis **decreases** as the distance of the lamp  
from the pond plant increases.

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

[Total: 13]

4 (a) Mammals have a double circulatory system.

Explain what is meant by a *double circulatory system*.

.....  
..... [1]

Fig. 4.1 shows sections of three blood vessels: an artery, a capillary and a vein.

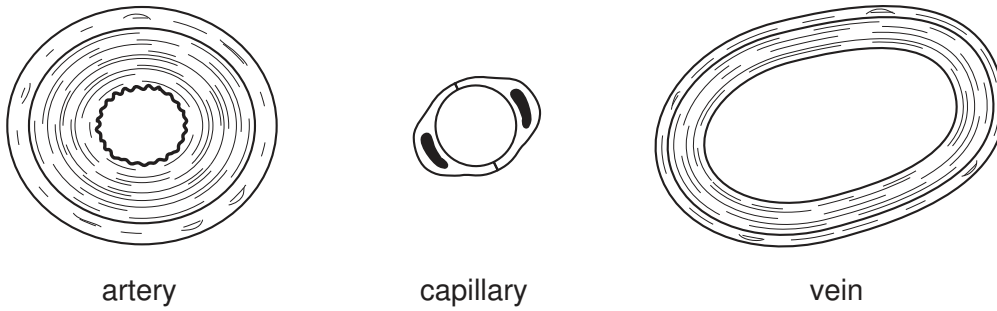


Fig. 4.1

(b) State **one** function for each of the blood vessels shown in Fig. 4.1.

*artery* .....

.....

*capillary* .....

.....

*vein* .....

..... [3]

(c) Explain how the **structure of the artery** shown in Fig. 4.1 is adapted to its function.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

(d) Explain how valves help the transport of blood in veins.

.....

.....

.....

..... [2]

[Total: 10]

*For  
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Use*

5 (a) Four definitions of terms used in genetics are shown in Table 5.1.

For  
Examiner's  
Use

Table 5.1

definitions	terms
the outward appearance of an organism	.....
a length of DNA that codes for a protein	.....
having one set of chromosomes	.....
type of nuclear division which gives daughter nuclei that are genetically identical	.....

For each of the definitions, select an appropriate term from the list and write it in the box provided.

- |            |              |           |
|------------|--------------|-----------|
| chromosome | genotype     | mitosis   |
| diploid    | haploid      | mutation  |
| dominant   | heterozygous | phenotype |
| gene       | homozygous   | recessive |

[4]

(b) A couple who have blood groups **A** and **B** have four children. Each child has a different blood group.

Use the space below to draw a genetic diagram to show how this is possible. Use the symbols,  $I^A$ ,  $I^B$  and  $I^o$ , for the alleles.

parental blood groups	<b>A</b>	×	<b>B</b>
parental genotypes	.....	×	.....
gamete genotypes	.....		.....
children's genotypes	.....		.....
children's blood groups	.....		.....

[4]

(c) Explain what is meant by *codominance*. You may refer to the genetic diagram in (b) to help you with your answer.

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

(d) Insulin produced by genetically engineered bacteria first became available in 1982. Before 1982, insulin had been prepared from dead animal tissues.

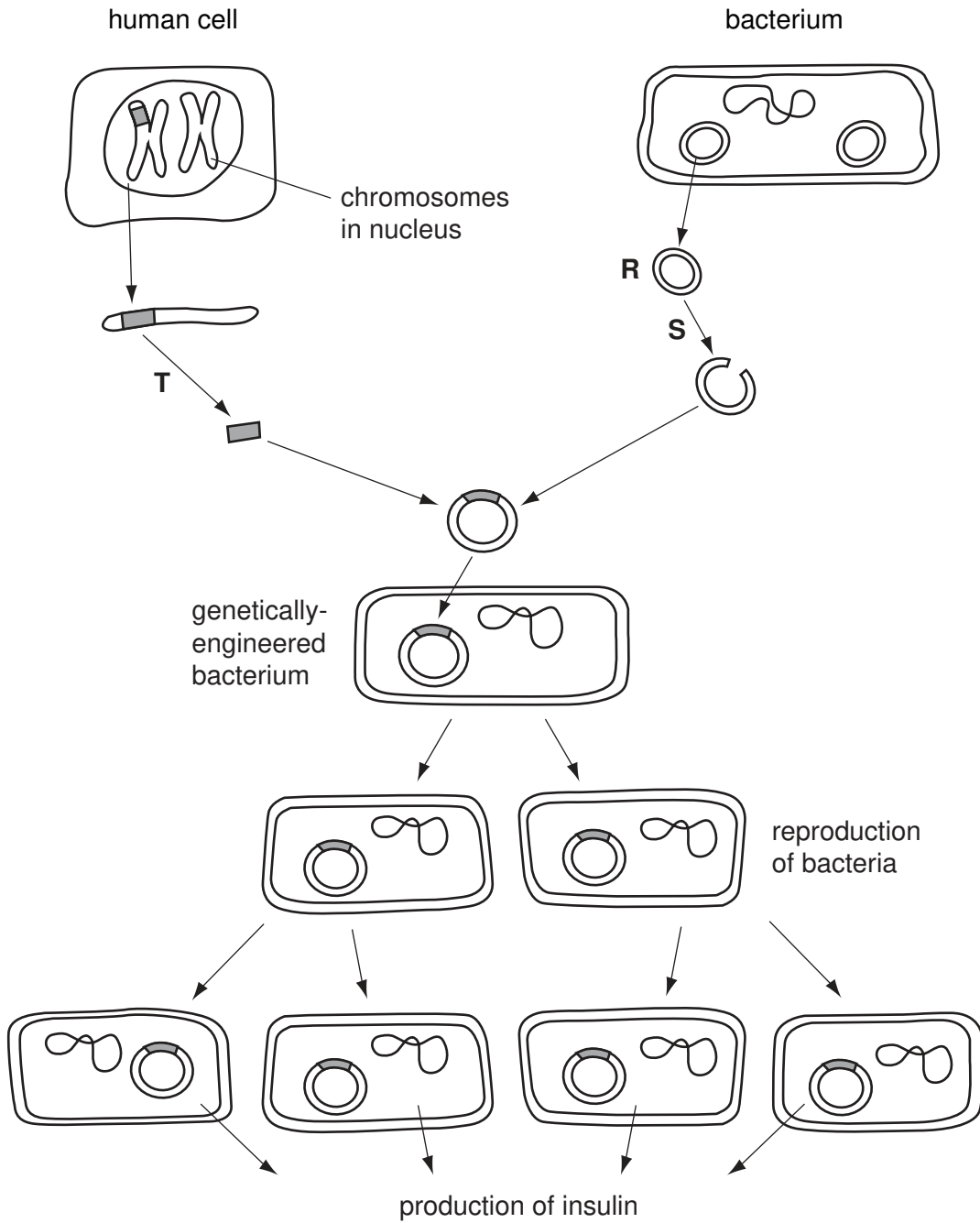
Explain the **advantages** of using insulin produced by genetically engineered bacteria rather than insulin from dead animal tissues.

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

For  
Examiner's  
Use

(e) Fig. 5.1 shows some of the steps involved in the genetic engineering of bacteria.

For  
Examiner's  
Use



**Fig. 5.1**

(i) Name structure **R** and state what it is made from.

..... [2]

(ii) State what is added at stages **S** and **T**.

..... [1]

[Total: 17]

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**QUESTION 6 STARTS ON THE NEXT PAGE**

6 (a) List four chemical elements that are found in proteins.

- 1. ....
- 2. ....
- 3. ....
- 4. .... [4]

Fig. 6.1 is a photograph of some root nodules from a pea plant, which is a type of legume.



Fig. 6.1

(b) Nodules like those in Fig. 6.1 develop on the roots of pea plants and other legumes when the soil is lacking in nitrate ions.

Explain what happens inside the nodule to help legume plants grow in soils lacking nitrate ions.

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



(c) After the peas have been harvested, the plants are ploughed back into the soil.

Describe what happens in the soil to convert dead plant material into nitrate ions that plants can absorb.

.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
..... [6]

(d) Nutrients in the soil can act as a limiting factor for crop growth.

List three **other** factors that may limit the growth of a crop plant.

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

QUESTION 6 CONTINUES ON PAGE 18

For  
Examiner's  
Use

- (e) The soya bean aphid is an insect pest of soya bean plants in North America. The aphids can show an exponential growth rate where populations can double in two to three days under favourable conditions.

For  
Examiner's  
Use

Fig. 6.2 shows the growth of soya bean aphids in a field in North America during the growing season.

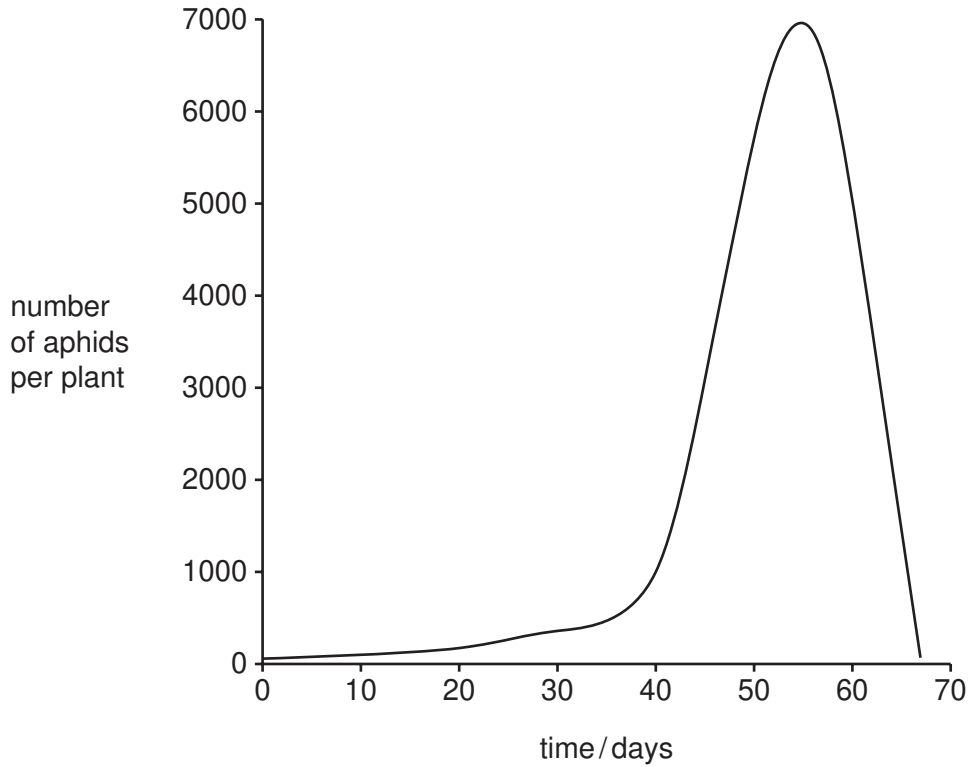


Fig. 6.2

Suggest why the population of aphids did not increase rapidly until about day 40.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 19]



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*Copyright Acknowledgements:*

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