

Surname	Centre Number	Candidate Number
Other Names		0



**GCSE**

4471/02



S15-4471-02

**ADDITIONAL SCIENCE/BIOLOGY**

**BIOLOGY 2  
HIGHER TIER**

P.M. TUESDAY, 12 May 2015

1 hour

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	6	
2.	8	
3.	4	
4.	6	
5.	6	
6.	6	
7.	5	
8.	6	
9.	7	
10.	6	
<b>Total</b>	<b>60</b>	

**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.

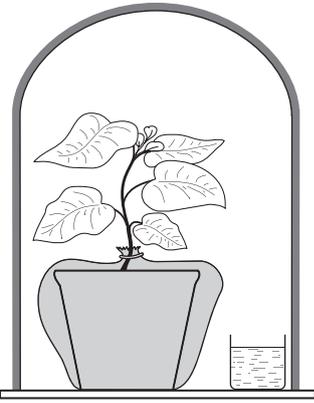
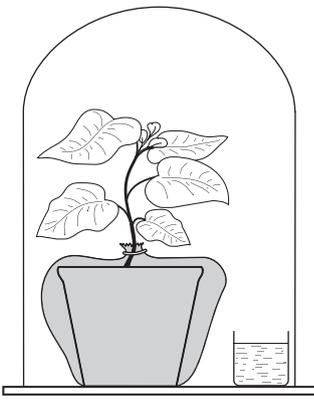
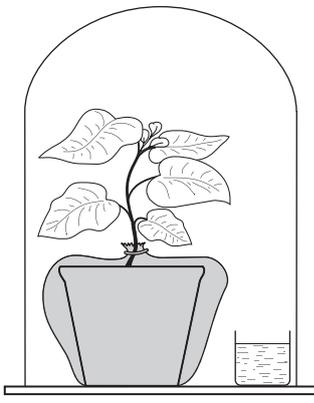
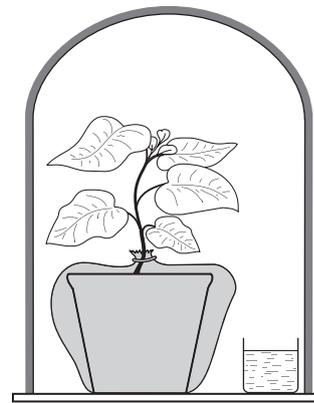
You are reminded that assessment will take into account the quality of written communication (QWC) used in your answer to question **4** and question **10**.

Answer all questions.

1. (a) Complete the word equation for photosynthesis shown below. [2]

carbon dioxide + .....  $\longrightarrow$  glucose + .....

- (b) The diagrams below show four experiments used to investigate the conditions needed for photosynthesis. Four well-watered potted green plants were placed in glass bell jars, which were sealed onto greased glass plates. The soil in each pot was covered with a polythene sheet. Each apparatus was then subjected to different environmental conditions.

<p><b>Experiment A</b></p> <ul style="list-style-type: none"> <li>• Bell jar covered in thick black paper</li> <li>• Beaker contains a chemical that <b>produces</b> carbon dioxide</li> </ul> 	<p><b>Experiment B</b></p> <ul style="list-style-type: none"> <li>• Beaker contains a chemical that <b>produces</b> carbon dioxide</li> </ul> 
<p><b>Experiment C</b></p> <ul style="list-style-type: none"> <li>• Beaker contains a chemical that <b>absorbs</b> carbon dioxide</li> </ul> 	<p><b>Experiment D</b></p> <ul style="list-style-type: none"> <li>• Bell jar covered in thick black paper</li> <li>• Beaker contains a chemical that <b>absorbs</b> carbon dioxide</li> </ul> 

- (i) After 3 days, leaves from each of the four plants were tested for starch. Complete the table below by placing a ✓ or a X in each box to show the presence or absence of starch. [2]

experiment	presence or absence of starch ✓ or X
<b>A</b>	
<b>B</b>	
<b>C</b>	
<b>D</b>	

- (ii) The results from which **two** experiments should be compared to show that

I. carbon dioxide is needed for photosynthesis,

[1]

.....

II. light is needed for photosynthesis?

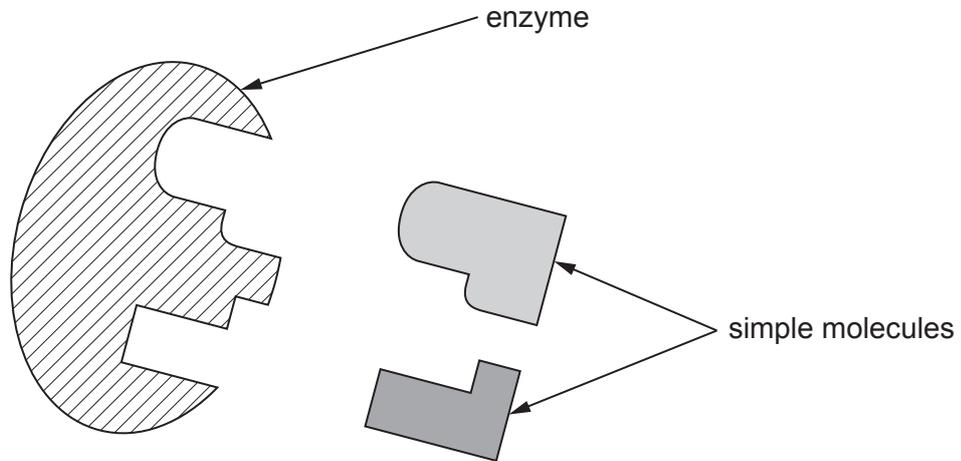
[1]

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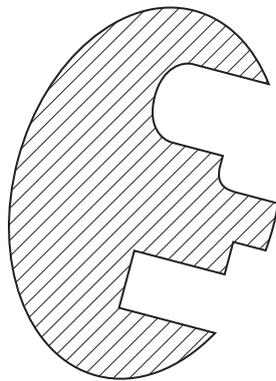
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2. (a) (i) The diagram shows an enzyme which builds up complex molecules from simple molecules.



Complete the diagram below to show the next stage in the reaction between this enzyme and the two simple molecules shown above. [2]



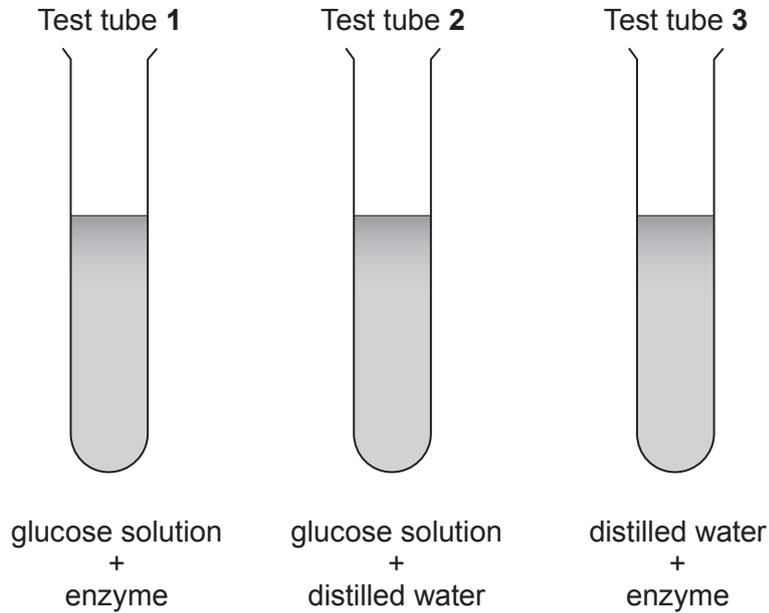
- (ii) What name is given to this **model** of enzyme action? [1]

.....

- (iii) Explain how boiling would affect the action of the enzyme shown in the diagrams above. [2]

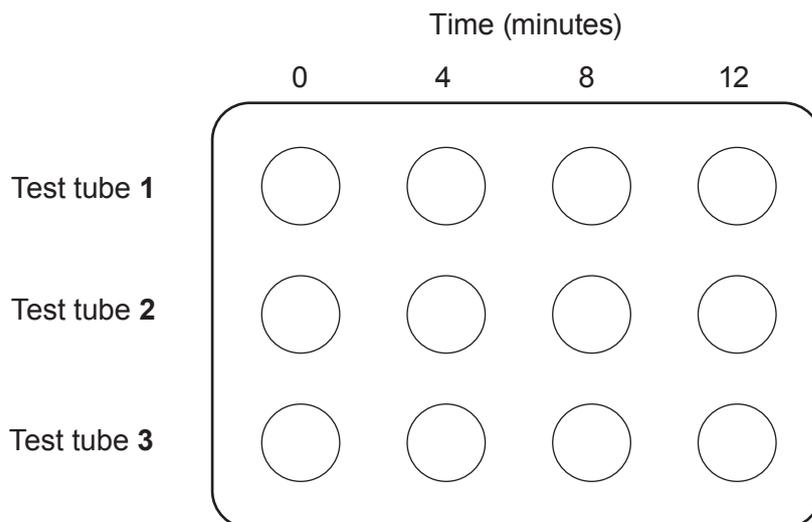
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- (b) Potatoes contain an enzyme which converts glucose molecules into starch molecules. In the following experiment three test tubes were set up as shown in the diagram below.

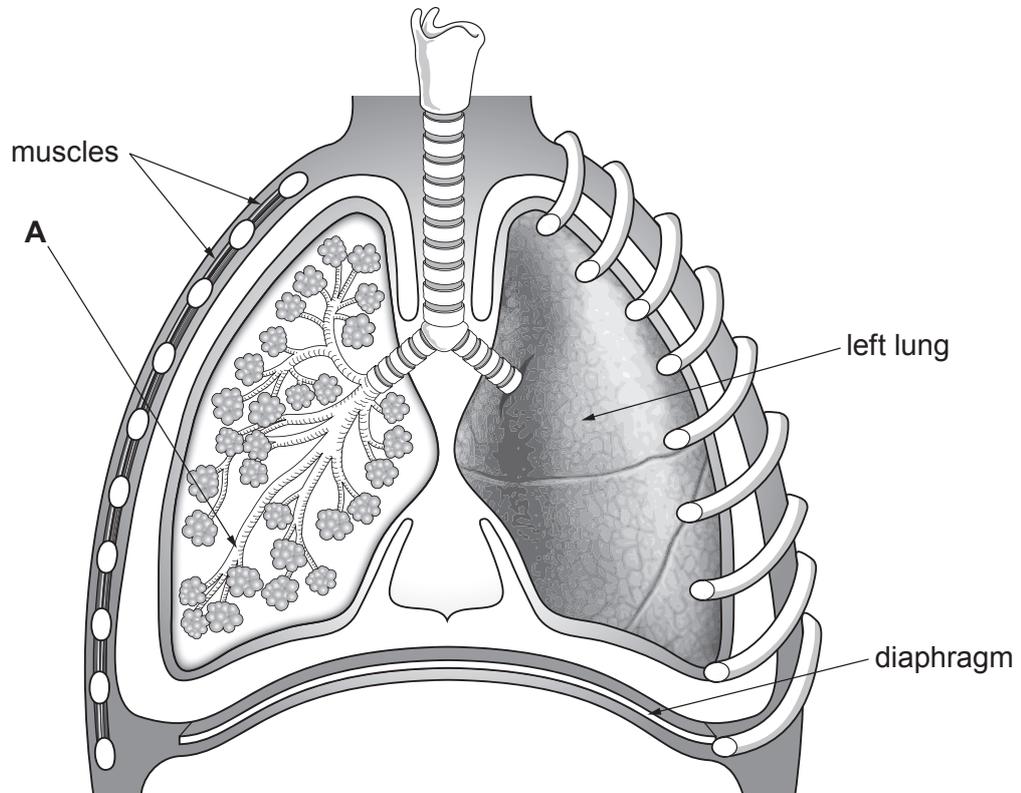


At the start of the experiment, and at four minute intervals, samples from each of the test tubes were added to each of the cavities in a spotting tray and then iodine solution was added to each sample.

Complete the diagram below by shading the cavities you would expect to show the presence of starch when tested with iodine solution. [3]



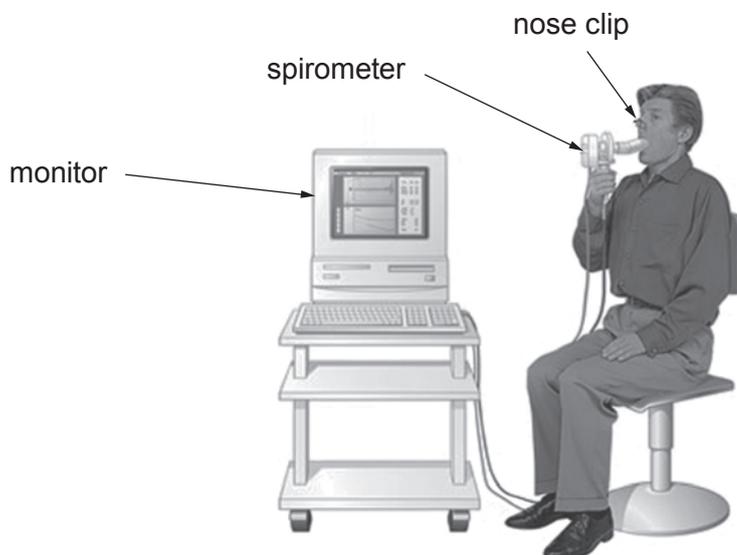
3. The diagram below shows the human respiratory system.



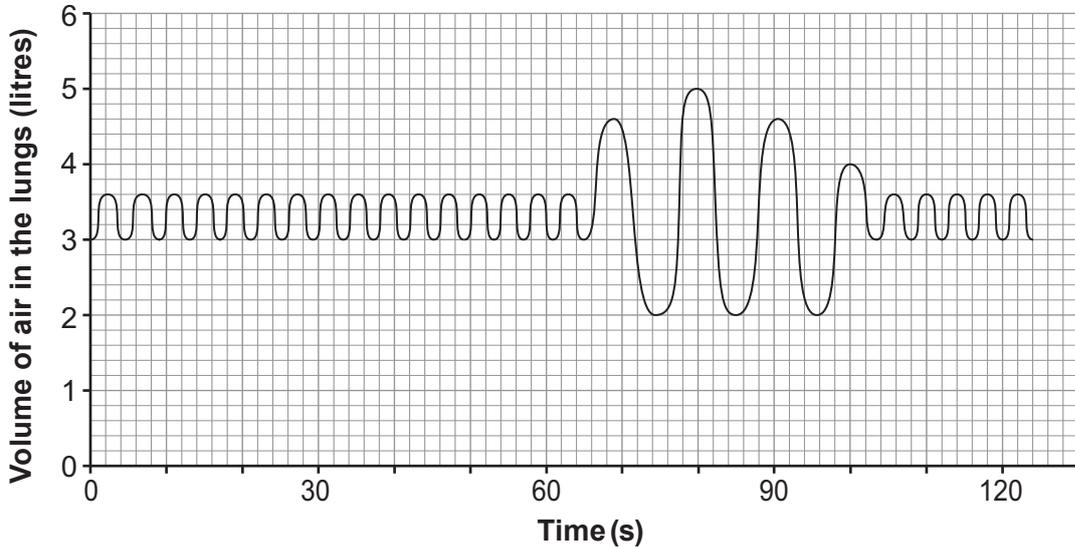
- (a) Name structure **A** on the diagram.

[1]

- (b) A person's breathing rate was measured on a spirometer for 120 seconds.



The person breathed normally, then took deep breaths and then breathed normally again. A graph of this breathing pattern was printed and is shown below.



Use the graph to:

- (i) calculate the normal breathing rate for this person, [1]

normal breathing rate = ..... breaths per minute

- (ii) calculate the difference between the volume of air inspired during a single normal breath and the **second** deep breath taken. [2]

difference in volume = .....

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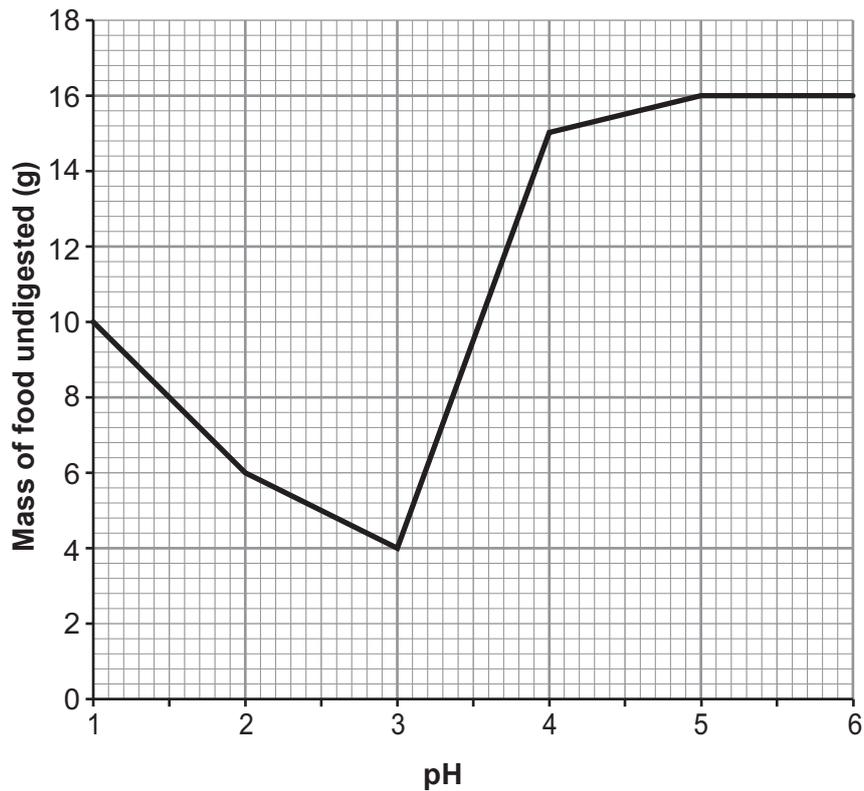
5. (a) The following statement refers to a process that occurs in the digestive system.  
*'The muscles in front of the food relax whilst the muscles behind the food contract.'*

Name the process being described.

[1]

.....

- (b) The graph shows the results of an investigation into the activity of an enzyme at various pH levels. The enzyme was acting on a food substance and the mass of this food substance remaining undigested at each of the pH levels was recorded.



- (i) State what happens to the mass of undigested food from pH3 to pH6.

[2]

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

- (ii) State the optimum pH of this enzyme.

[1]

.....

- (iii) Name the organ in the human body where this enzyme is found and name the class of food it acts on.

[2]

organ .....

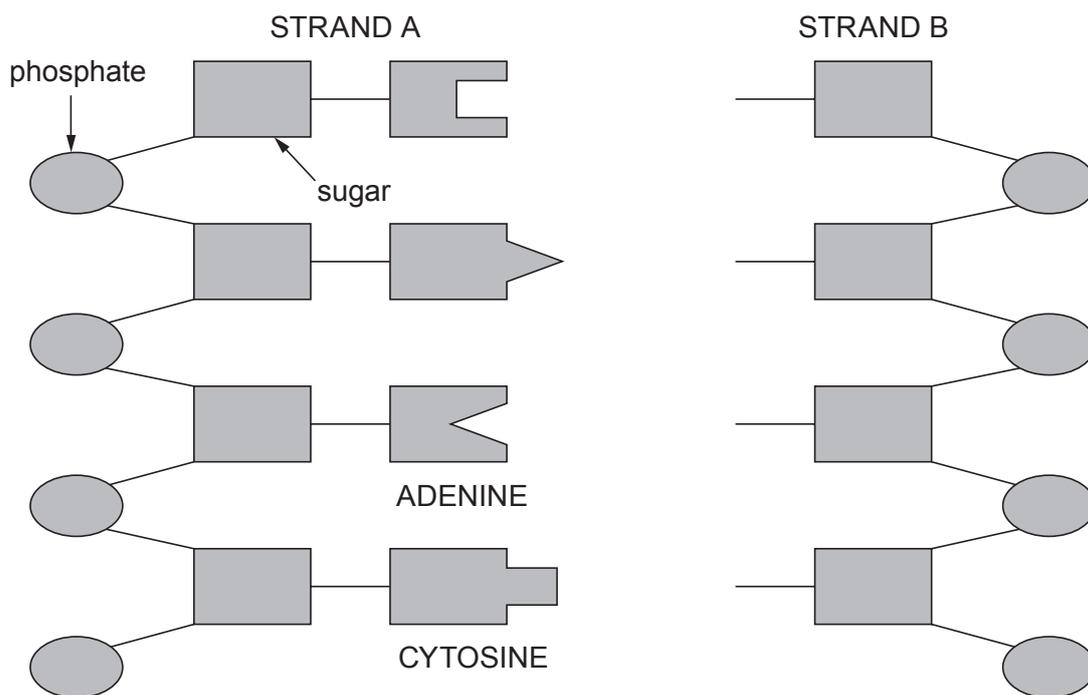
food substance .....

6. A DNA molecule consists of two coiled strands. When cells divide, the two strands in the DNA separate. The bases of each strand pair with complementary bases to make new DNA.

(a) Complete the diagram below to show the sequence of complementary bases that would appear in this DNA molecule by:

(i) drawing the shapes of the **four** missing complementary bases in strand B; [2]

(ii) label **each** of them with their correct **names**. [2]



(b) Describe how a section of DNA can control the formation of a protein. [2]

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7. Tom jogged for twenty minutes. The table below shows data about the concentration of lactic acid in his blood during this period of exercise.

time from start (min)	concentration of lactic acid in blood (mg/100 cm <sup>3</sup> )
0	4
2	15
4	29
6	44
8	42
10	39
12	30
14	22
16	20
18	18
20	16

Use the data given and your knowledge to answer the questions below.

- (a) (i) How many minutes after the start of the exercise was the highest oxygen debt recorded? [1]

.....

- (ii) What type of respiration results in oxygen debt? [1]

.....

- (iii) When would Tom be releasing most energy per glucose molecule? Explain your answer. [2]

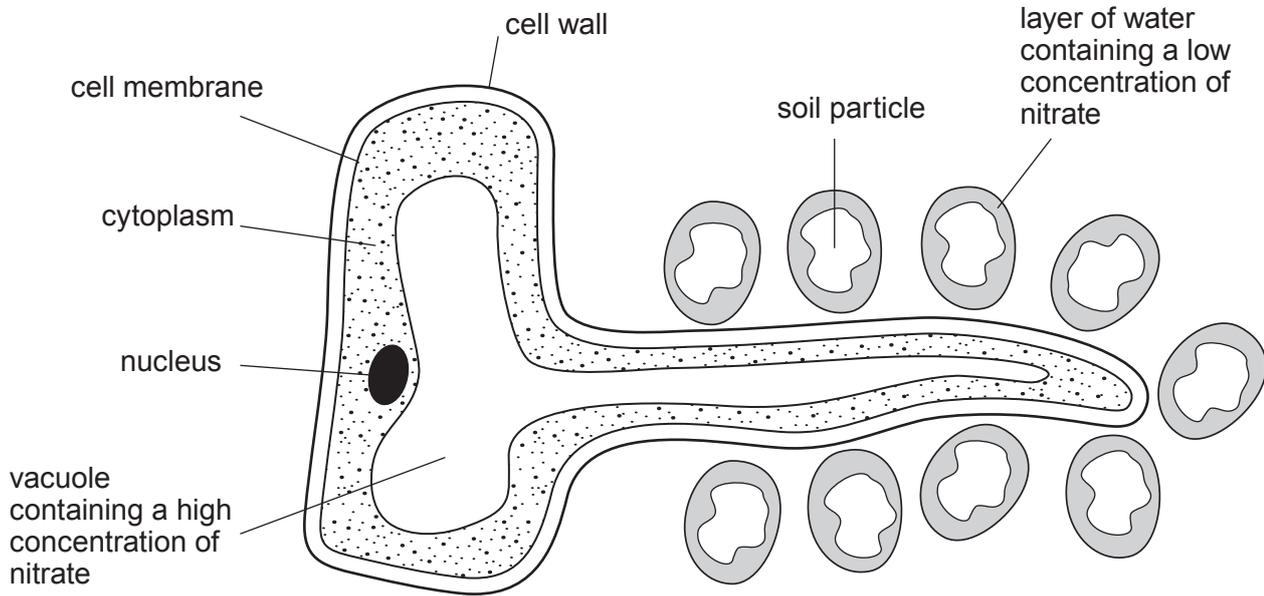
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- (b) Which type of cell would be producing lactic acid? [1]

.....

8. The diagram below shows a **section** through a root hair cell in well-watered soil.



(a) State the method used by the root hair cell to take up nitrate from the soil. [1]

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(b) Gardeners dig soil to let more air into it. Explain why this increases the uptake of nitrate by root hair cells. [2]

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(c) Describe how the root hair cell takes up water by osmosis. [3]

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9. The Rose-bay willow-herb, *Epilobium angustifolium* is a plant that produces wind dispersed seeds.



The survival of this plant in its natural habitat was studied by counting the number of

- seeds found on the ground,
- seedlings,
- fully grown plants.

The counts were completed every 2 metres away from the parent population.

All counts were taken in the direction of the prevailing wind (direction in which the wind mainly blows).

The results are shown in the table:

distance from parent population (m)	seeds (per m <sup>2</sup> )	seedlings (per m <sup>2</sup> )	fully grown plants (per m <sup>2</sup> )
2	22	20	0
4	30	25	0
6	31	30	0
8	28	25	1
10	25	20	2
12	18	15	3
14	9	9	5
16	8	5	5
18	4	3	3

(a) Name:

(i) the technique you would use to obtain the data shown in the table; [1]

.....

(ii) **two** items of apparatus used to make the necessary measurements for this technique. [2]

.....

(b) Calculate the percentage of seeds that survived to produce fully grown plants at 10 m from the parent plants. Show your working. [2]

Percentage of fully grown plants surviving = ..... %

(c) Explain why no fully grown plants are found within 6 m of the parent population. [2]

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7

