



**Surname** \_\_\_\_\_

**Other Names** \_\_\_\_\_

**Centre Number** \_\_\_\_\_

**Candidate Number** \_\_\_\_\_

**Candidate Signature** \_\_\_\_\_

**GCSE**

**COMBINED SCIENCE: SYNERGY**

**Foundation Tier Paper 2**

**Life and environmental sciences**

**F**

**8465/2F**

**Wednesday 22 May 2019**

**Afternoon**

**Time allowed: 1 hour 45 minutes**

**At the top of the page, write your surname and other names, your centre number, your candidate number and add your signature.**

**[Turn over]**



JUN1984652F01

**For this paper you must have:**

- **a ruler**
- **a protractor**
- **a scientific calculator**
- **the periodic table (enclosed)**
- **the Physics Equations Sheet (enclosed).**

## **INSTRUCTIONS**

- **Use black ink or black ball-point pen.**
- **Answer ALL questions in the spaces provided. Do not write on blank pages.**
- **Do all rough work in this book. Cross through any work you do not want to be marked.**
- **In all calculations, show clearly how you work out your answer.**



## **INFORMATION**

- **The maximum mark for this paper is 100.**
- **The marks for questions are shown in brackets.**
- **You are expected to use a calculator where appropriate.**
- **You are reminded of the need for good English and clear presentation in your answers.**

**DO NOT TURN OVER UNTIL TOLD TO DO SO**



**Answer ALL questions in the spaces provided.**

**0 1**

**FIGURE 1, on the opposite page, shows four waves, A, B, C and D.**

**All four waves are shown on oscilloscope screens.**

**The oscilloscope settings are the same for each screen.**

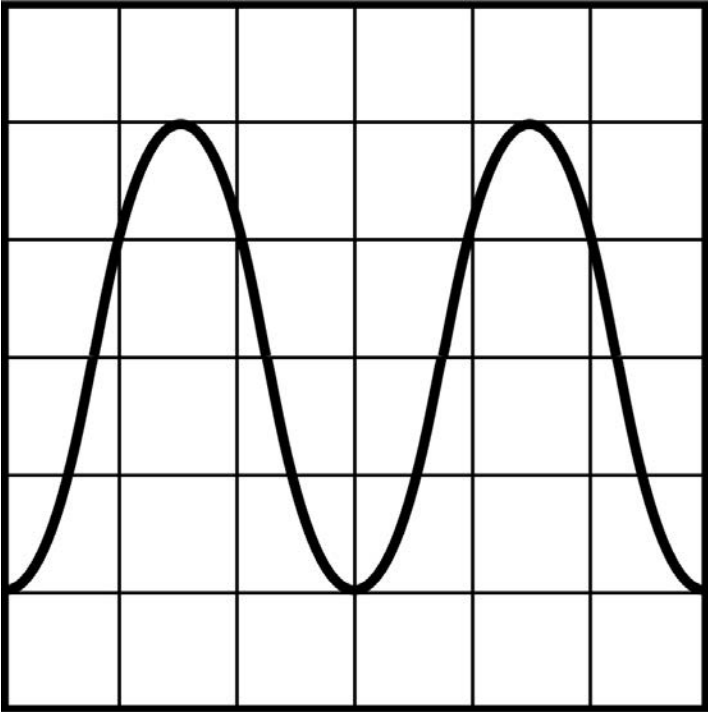
**0 1 . 1**

**Which wave has the smallest amplitude? [1 mark]**

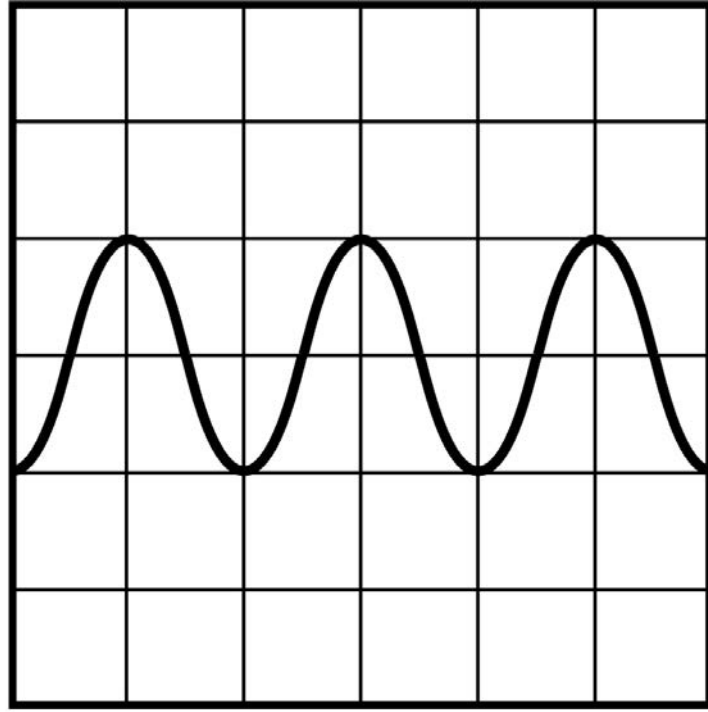
**Tick (✓) ONE box on the opposite page.**

**FIGURE 1**

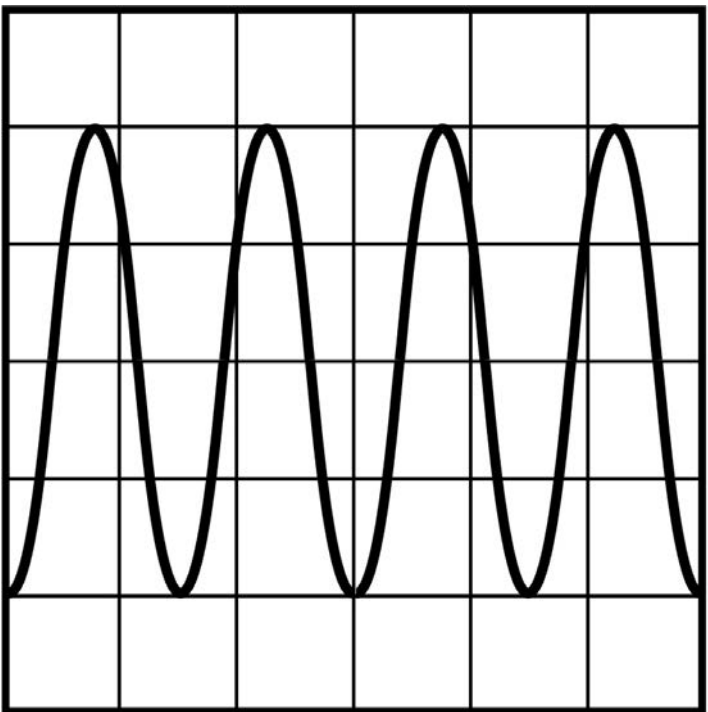
**A**



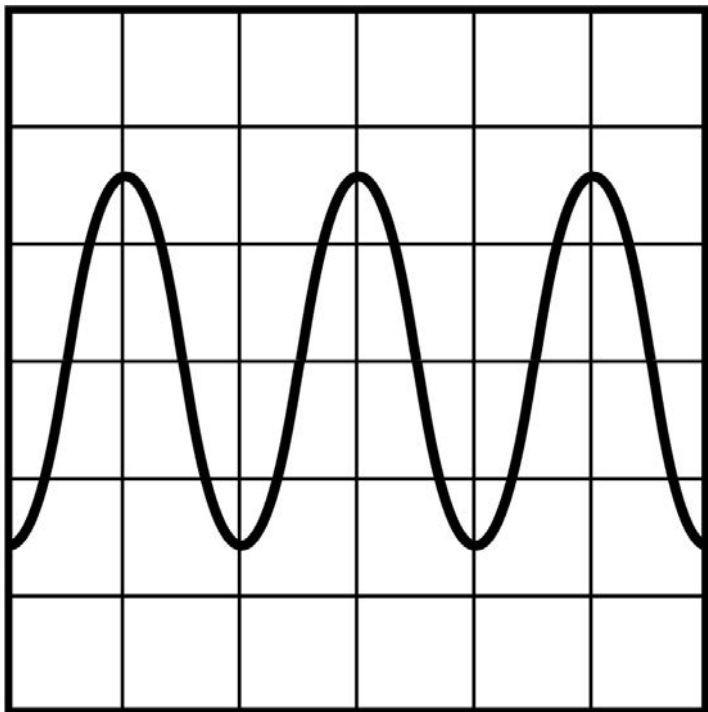
**B**



**C**



**D**



**[Turn over]**



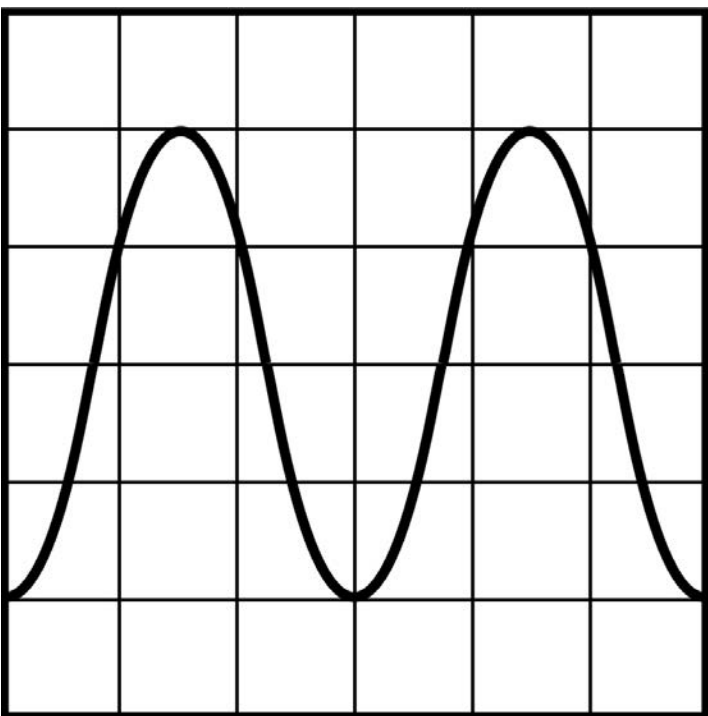
0 1 . 2

Which wave has the highest frequency?  
[1 mark]

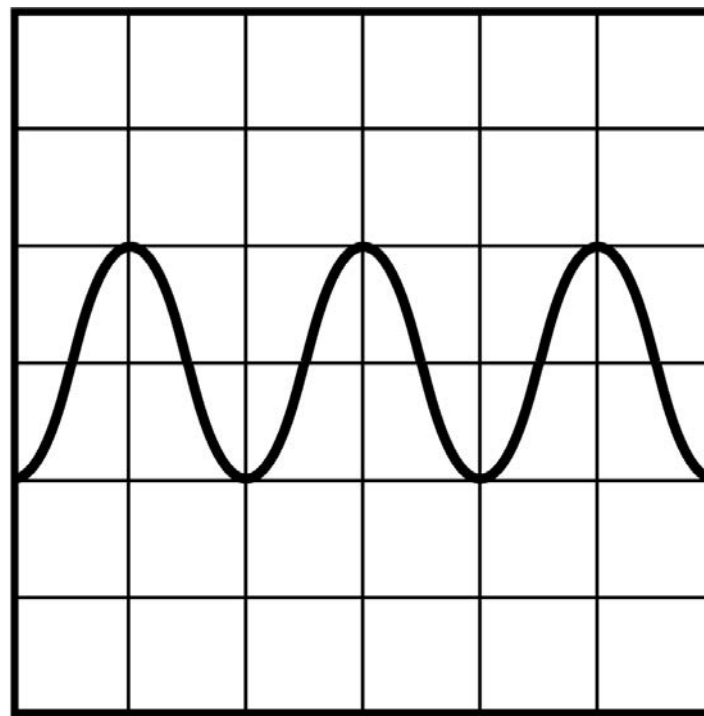
Tick (✓) ONE box.

FIGURE 1

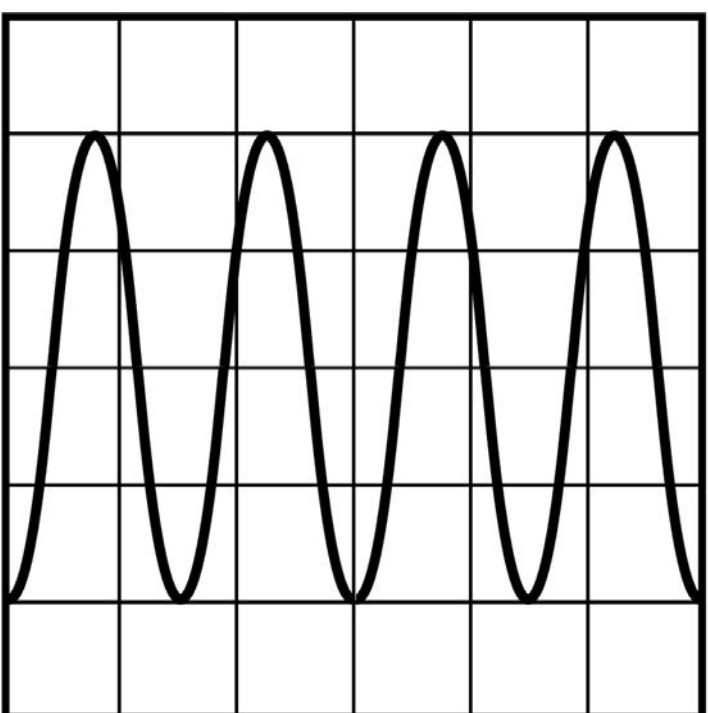
A



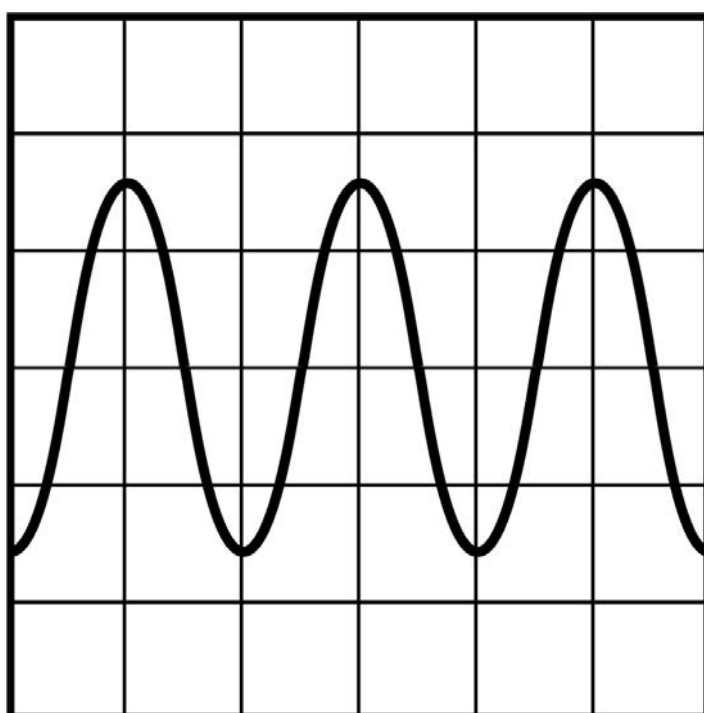

B




C




D



0	1	.	3
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**How many complete wavelengths are shown in wave A? [1 mark]**

**Number of complete wavelengths =**

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**[Turn over]**



**01.4**

**Draw ONE line from each quantity associated with a wave to the unit the quantity is measured in. [3 marks]**

**QUANTITY****UNIT****Hz****frequency****m****period****m<sup>3</sup>****wavelength****m<sup>2</sup>****s**



0	1	.	5
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**Which equation is used to calculate wave speed? [1 mark]**

**Tick (✓) ONE box.**

**Wave speed =  
frequency × wavelength**

**Wave speed =  $\frac{\text{frequency}}{\text{wavelength}}$**

**Wave speed =  
frequency – wavelength**

**Wave speed =  $\frac{\text{wavelength}}{\text{frequency}}$**

**[Turn over]**



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**01.6**

**Waves can be longitudinal or transverse.**

**Which of the following is an example of a longitudinal wave? [1 mark]**

**Tick (✓) ONE box.**

**Sound**

**Visible light**

**Wave on a string**

**[Turn over]**



**Some students banged two blocks of wood together to produce a sound.**

**The students used a stopwatch to measure the time taken for the sound to travel 100 m**

**TABLE 1 shows the results.**

**TABLE 1**

<b>TEST</b>	<b>Time taken in SECONDS</b>
<b>1</b>	<b>0.32</b>
<b>2</b>	<b>0.36</b>
<b>3</b>	<b>0.34</b>
<b>MEAN</b>	<b>X</b>

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**[Turn over]**



**01.7**

**Calculate mean value X in TABLE 1, on page 12. [1 mark]**

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**X = \_\_\_\_\_ s**

**01.8**

**Determine the speed of sound in air.**

**Use your answer from Question 01.7.**

**Use the equation:**

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

**[1 mark]**



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Speed = \_\_\_\_\_ m/s

**0** **1** . **9**

**Why is it difficult to accurately measure the time taken for the sound to travel 100 m using a stopwatch? [1 mark]**

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**[Turn over]**

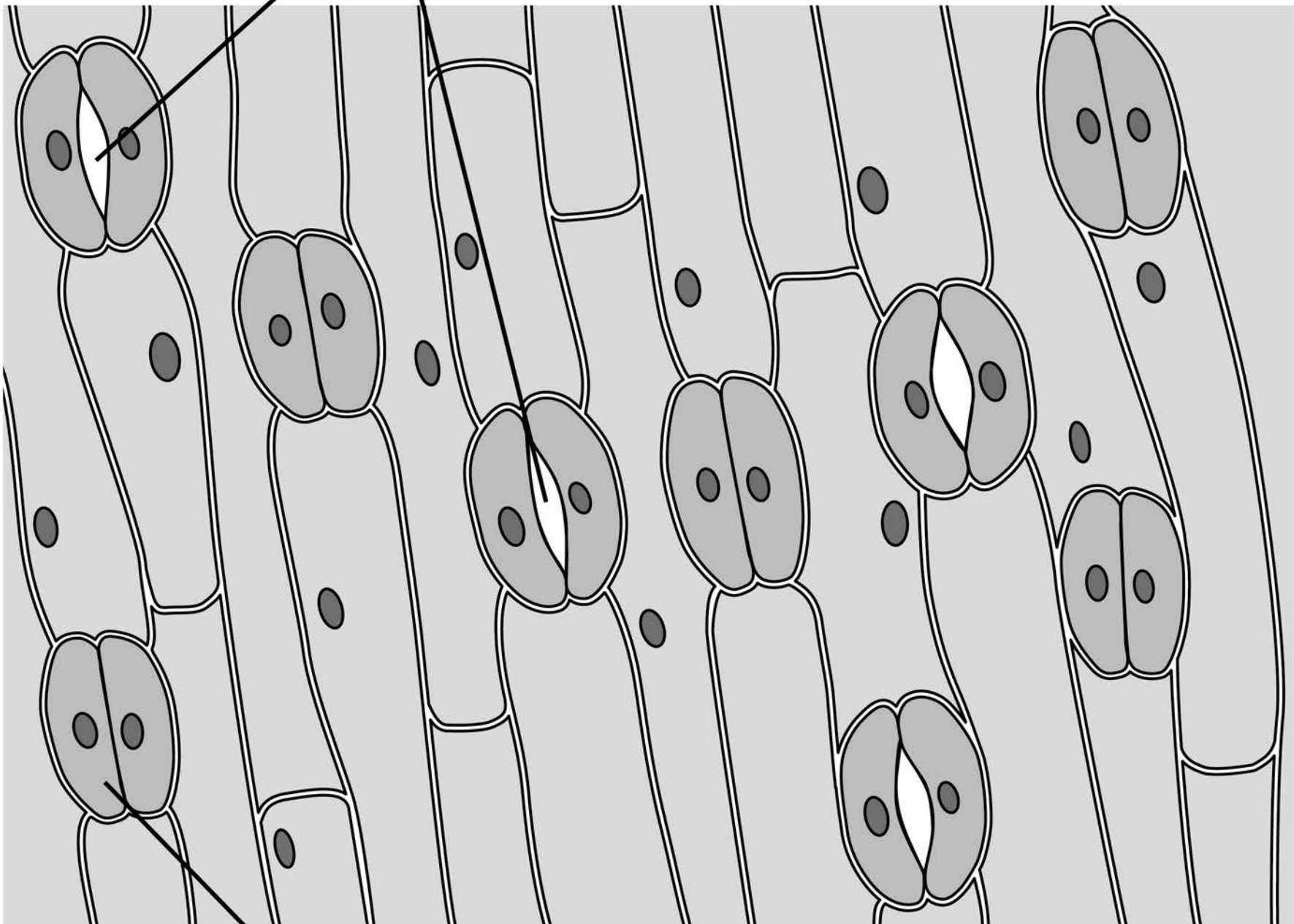
11

0 2

**FIGURE 2** shows part of a plant leaf seen through a microscope.

**FIGURE 2**

**Open stomata**



**X**



**02.1**

**X is a specialised plant cell.**

**What type of cell is X? [1 mark]**

**Tick (✓) ONE box.**

**Guard cell**

**Meristem cell**

**Xylem cell**

**[Turn over]**



**0 2 . 2**

**Cell X is 0.0083 mm in length.**

**How long is cell X in micrometres ( $\mu\text{m}$ )?**

**1 mm = 1000  $\mu\text{m}$**

**[1 mark]**

**Tick (✓) ONE box.**

**0.000083  $\mu\text{m}$**

**0.083  $\mu\text{m}$**

**0.83  $\mu\text{m}$**

**8.3  $\mu\text{m}$**



0	2	.	3
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**Calculate the percentage of stomata that are open in FIGURE 2, on page 16.  
[2 marks]**

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**Percentage = \_\_\_\_\_ %**

**[Turn over]**

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0	2	.	4
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**What is the function of stomata in a leaf? [1 mark]**

**Tick (✓) ONE box.**

**To allow water to enter the leaf**

**To control the transport of sugar**

**To control water loss from the leaf**

**To increase the temperature of the leaf**

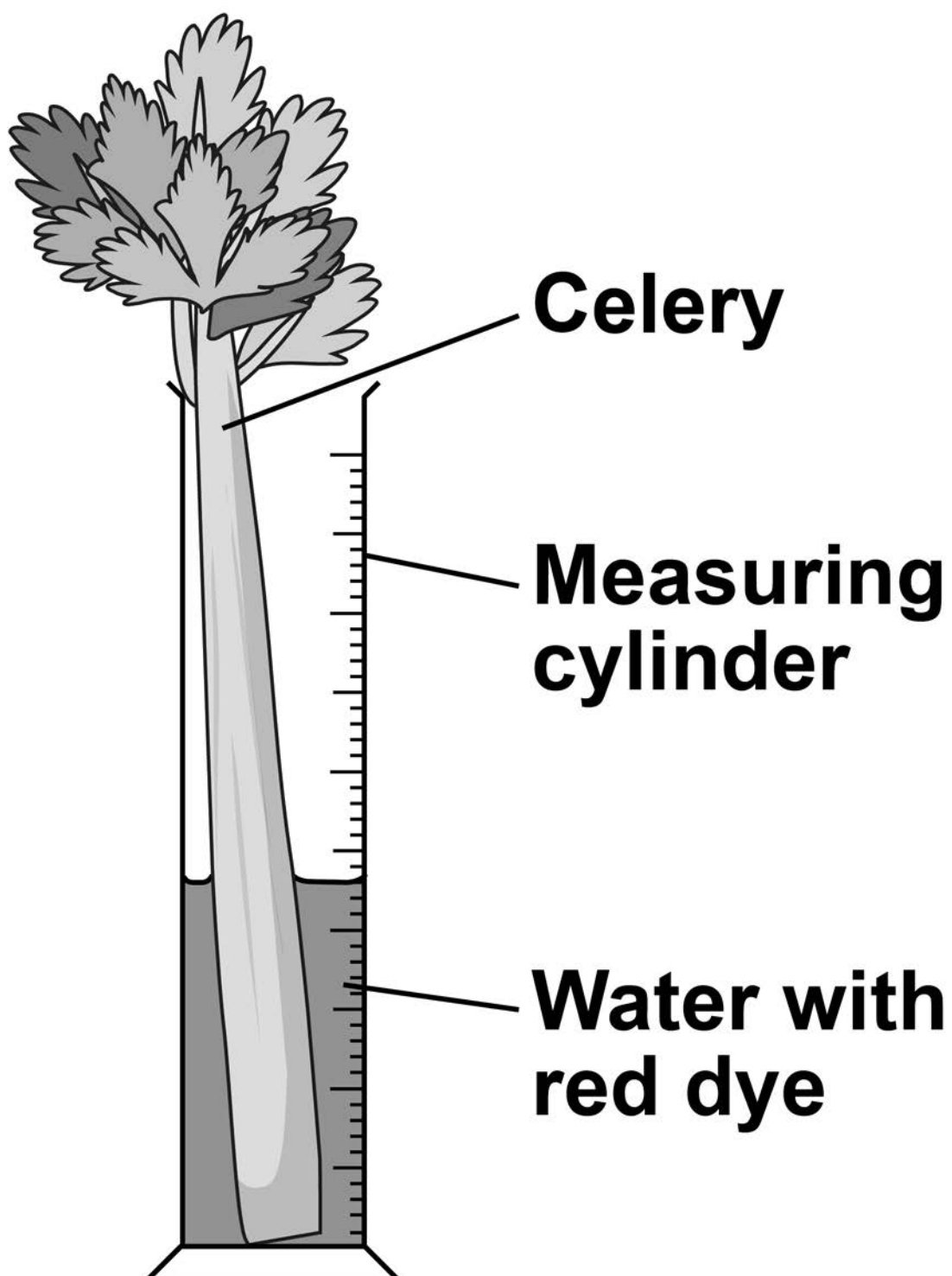
**[Turn over]**



A teacher used celery in an experiment to show water uptake in plants.

FIGURE 3 shows the apparatus used.

FIGURE 3



0 2 . 5

The celery was left in the water with red dye for three hours.

After three hours the leaves of the celery were dark red.

Explain how the leaves became dark red. [3 marks]

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[Turn over]

**0 2 . 6**

**The number of celery leaves on the celery stalk affects the RATE of water uptake.**

**Describe how the experiment could be altered to measure this effect.**

**[2 marks]**

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02.7

**Give TWO ways a student could increase the rate of water uptake of a plant in a school laboratory. [2 marks]**

1

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2

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**[Turn over]**

12

Four foods were tested for starch, sugar and protein.

TABLE 2 shows the results.

TABLE 2

Food	Test for starch: colour after iodine test	Test for sugar: colour after Benedict's test	Test for protein: colour after Biuret test
A	Blue-Black	Brick red	Blue
B	Orange	Blue	Lilac
C	Blue-Black	Yellow	Blue
D	Orange	Orange	Lilac

03.1

**Give THREE conclusions about food D. [3 marks]**

**1**

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**2**

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**3**

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**[Turn over]**



03.2

**Starch is broken down into glucose.**

**Which type of enzyme breaks down starch? [1 mark]**

**Tick (✓) ONE box.**

**Carbohydrase**

**Lipase**

**Protease**

03.3

**Which part of a cell releases energy from glucose?  
[1 mark]**

**Tick (✓) ONE box.**

**Mitochondria**

**Nucleus**

**Ribosomes**

**Vacuole**

**[Turn over]**



## Repeat of TABLE 2

<b>Food</b>	<b>Test for starch: colour after iodine test</b>	<b>Test for sugar: colour after Benedict's test</b>	<b>Test for protein: colour after Biuret test</b>
<b>A</b>	<b>Blue-Black</b>	<b>Brick red</b>	<b>Blue</b>
<b>B</b>	<b>Orange</b>	<b>Blue</b>	<b>Lilac</b>
<b>C</b>	<b>Blue-Black</b>	<b>Yellow</b>	<b>Blue</b>
<b>D</b>	<b>Orange</b>	<b>Orange</b>	<b>Lilac</b>

03.4

**Which food in TABLE 2 would be the most suitable for a person with Type 2 diabetes to eat?**

**Give TWO reasons for your answer. [3 marks]**

**Food** \_\_\_\_\_

**Reason 1** \_\_\_\_\_

\_\_\_\_\_

**Reason 2** \_\_\_\_\_

\_\_\_\_\_

**[Turn over]**

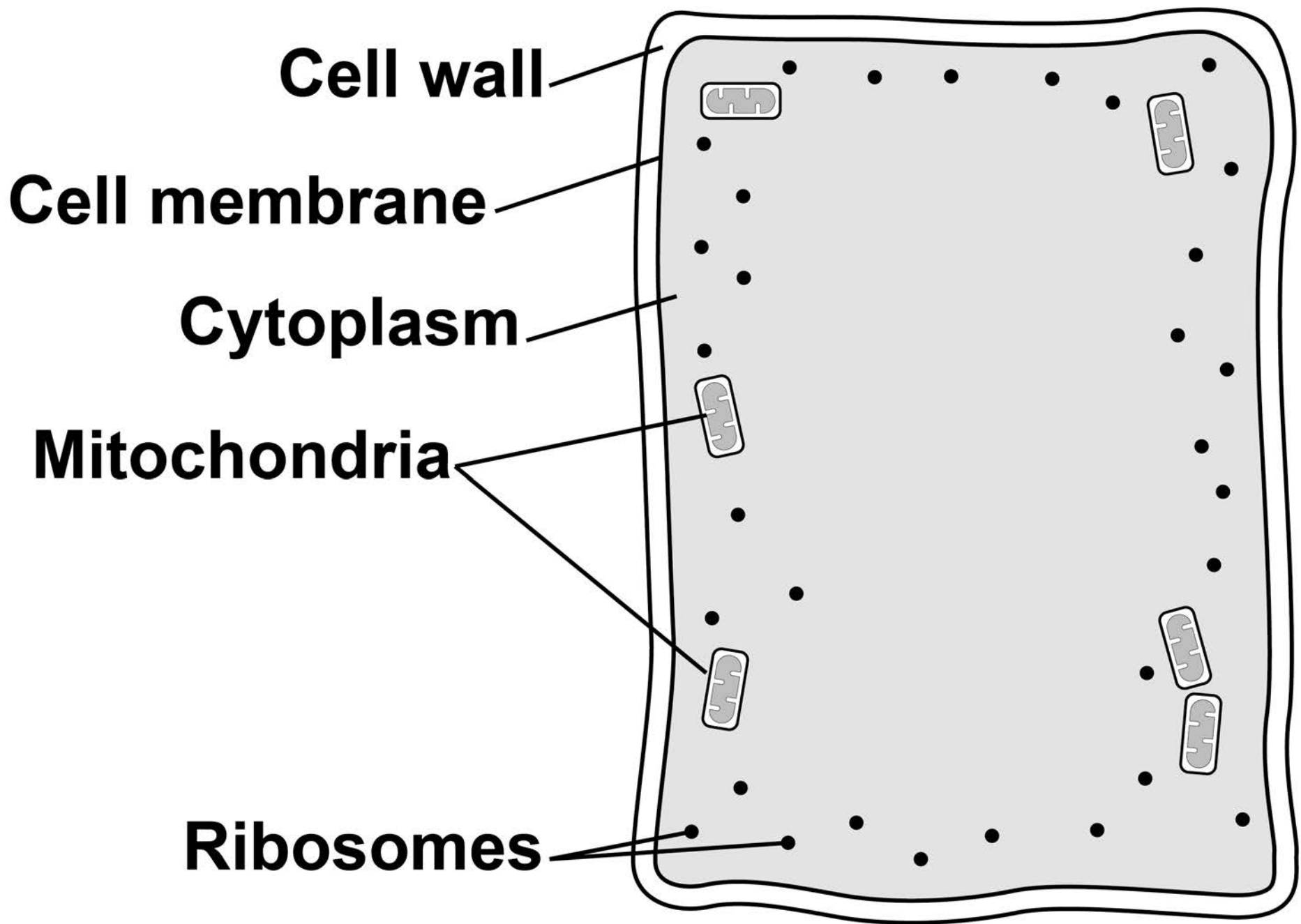
8



04

**FIGURE 4** shows some parts of a plant leaf cell.

**FIGURE 4**





04.1

**Name THREE parts of a plant leaf cell that are missing from FIGURE 4. [3 marks]**

1

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2

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3

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04.2

**What is the function of the cell wall in a plant cell? [1 mark]**

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**[Turn over]**



**Root cells absorb substances from the soil.**

**FIGURE 5, on the opposite page, shows the concentration of different substances outside a root cell and inside a root cell.**

**0 4 . 3**

**The cell membrane of a plant cell is partially permeable.**

**What does partially permeable mean?  
[1 mark]**

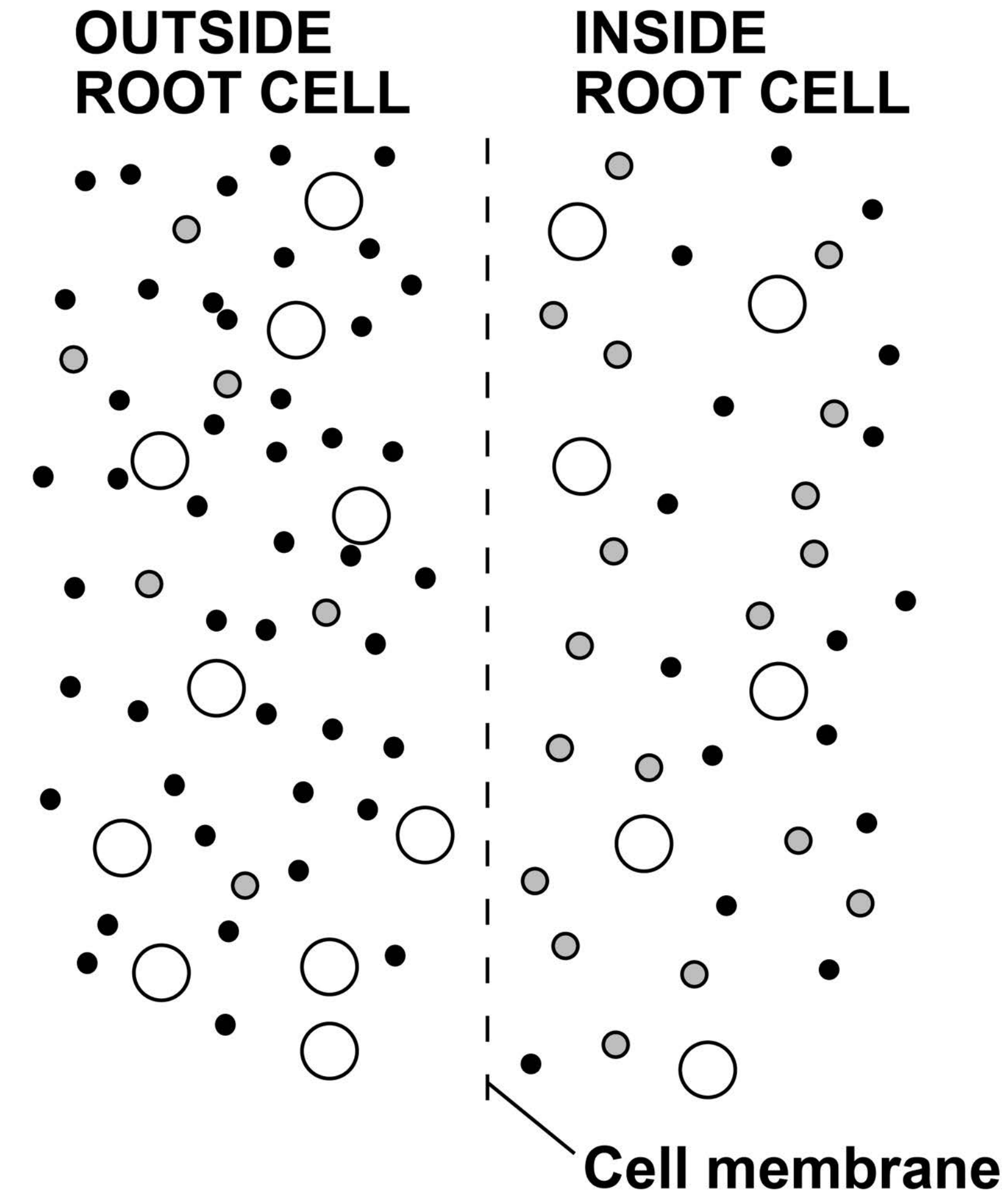
**Tick (✓) ONE box.**

**Allows all substances through**

**Allows no substances through**

**Allows some substances through**

FIGURE 5



**KEY**

- Water
- Potassium ion
- Substance C

[Turn over]



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0	4	.	4
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**How does water move into the root cell in FIGURE 5? [1 mark]**

**Tick (✓) ONE box.**

**By active transport**

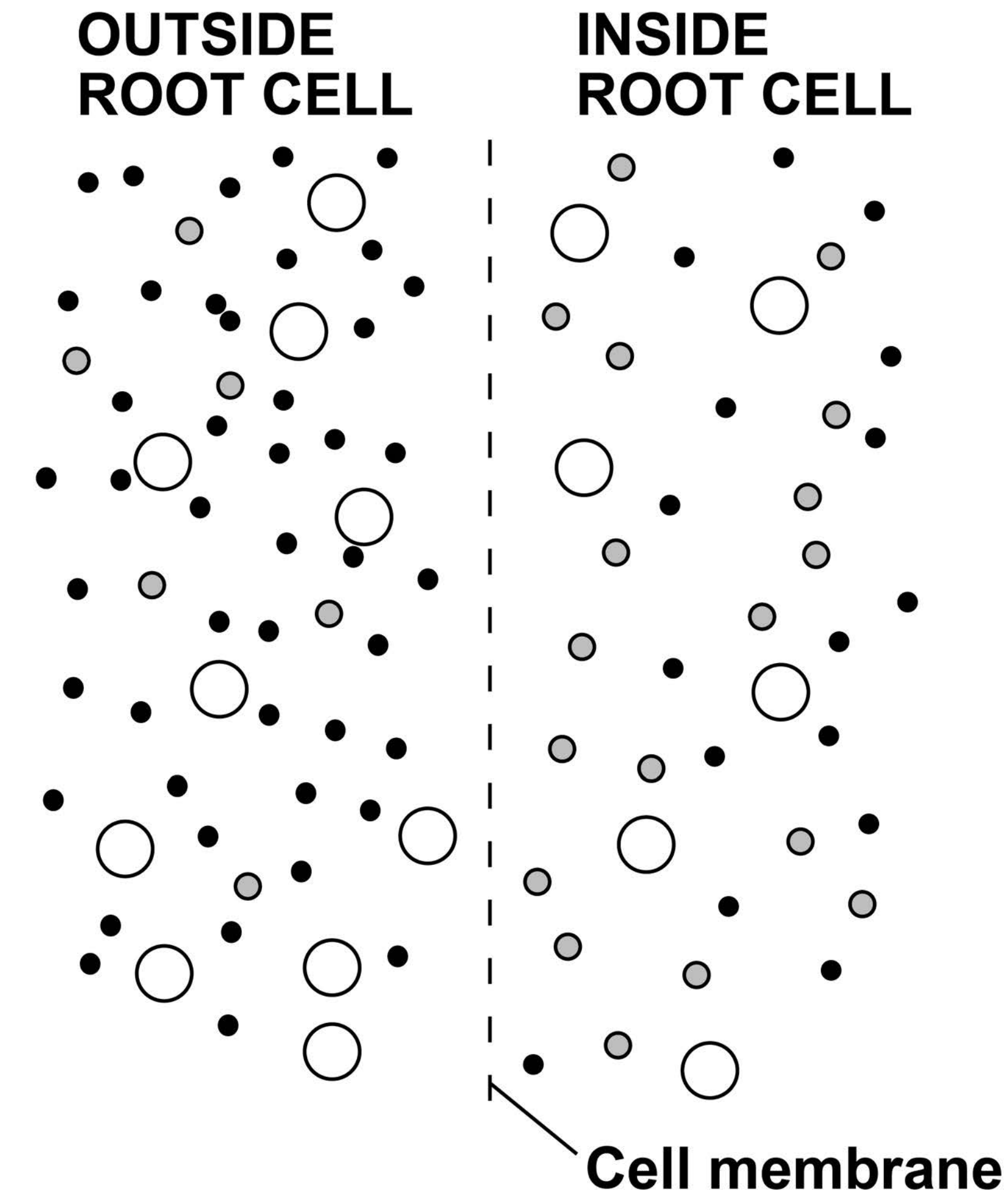
**By evaporation**

**By osmosis**

**[Turn over]**



## Repeat of FIGURE 5

**KEY**

- **Water**
- **Potassium ion**
- **Substance C**



0	4	.	5
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**How do potassium ions move into the root cell in FIGURE 5? [1 mark]**

**Tick (✓) ONE box.**

**By active transport**

**By diffusion**

**By osmosis**

**[Turn over]**

**BLANK PAGE**





0	4	.	6
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**Explain why substance C in FIGURE 5, on page 38, does NOT move into the root cell. [2 marks]**

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**[Turn over]**

**A student investigated the effect of different concentrations of sugar solution on the size of potato cubes.**

**This is the method used.**

- 1. Cut one potato cube.**
- 2. Record the size of the potato cube.**
- 3. Place the potato cube into a beaker of sugar solution.**
- 4. After 1 hour, record the size of the potato cube.**
- 5. Repeat steps 1– 4 using different concentrations of sugar solution.**

04.7

**Give THREE factors the student should control in the investigation. [3 marks]**

**1**

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**2**

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**3**

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**[Turn over]**

0	4	.	8
---	---	---	---

**What piece of equipment could the student use to accurately measure the length of each cube? [1 mark]**

**Tick (✓) ONE box.**

**Electronic balance**

**Measuring cylinder**

**Tape measure**

**Vernier callipers**



0	4	.	9
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**A potato cube is placed in sugar solution that is the same concentration as the concentration inside the potato cells.**

**What will happen to the size of the potato cube? [1 mark]**

**Tick (✓) ONE box.**

**The potato cube will decrease in size**

**The potato cube will increase in size**

**The potato cube will stay the same size**

**[Turn over]**

14



0	5
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**Plants can photosynthesise.**

0	5	.	1
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**Complete the word equation for photosynthesis. [1 mark]**

**carbon dioxide + water →  
glucose + \_\_\_\_\_**

0	5	.	2
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**Light is needed for photosynthesis.**

**Name the green pigment that absorbs light for photosynthesis. [1 mark]**

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0	5	.	3
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**Plants need carbon dioxide, water and energy for photosynthesis.**

**Complete the sentences. [3 marks]**

**Carbon dioxide is obtained from the**

\_\_\_\_\_ .

**Plant roots obtain water from the**

\_\_\_\_\_ .

**The energy for photosynthesis is from the**

\_\_\_\_\_ .

**[Turn over]**



**A rose bush has a disease called rose black spot.**

**05.4**

**What type of microorganism causes rose black spot? [1 mark]**

**Tick (✓) ONE box.**

**Bacterium**

**Fungus**

**Protist**

**Virus**



**05.5**

**Give TWO ways to prevent the spread of rose black spot to a different rose bush in the same area. [2 marks]**

**Tick (✓) TWO boxes.**

**Use a water spray to keep the leaves wet**

**Move the diseased rose bush to a different area**

**Remove the spotty leaves and burn them**

**Treat the rose bush with antibiotics**

**Give the rose bush liquid fertiliser**

**[Turn over]**



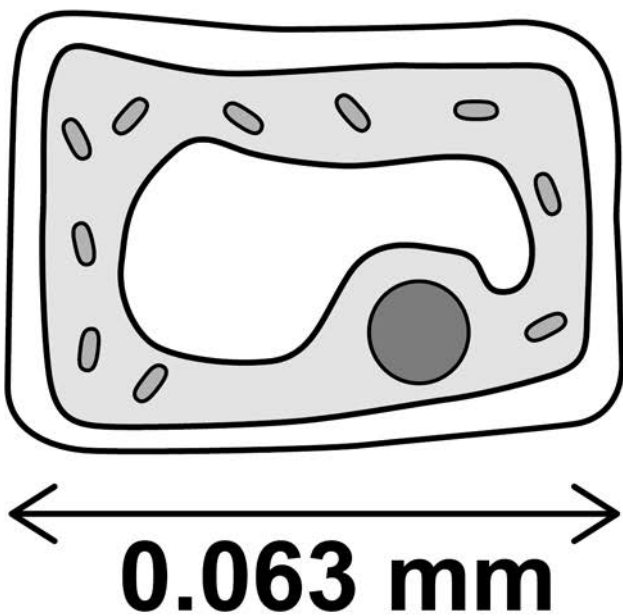
0	5	.	6
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**FIGURE 6** shows a plant cell and the microorganism that causes rose black spot.

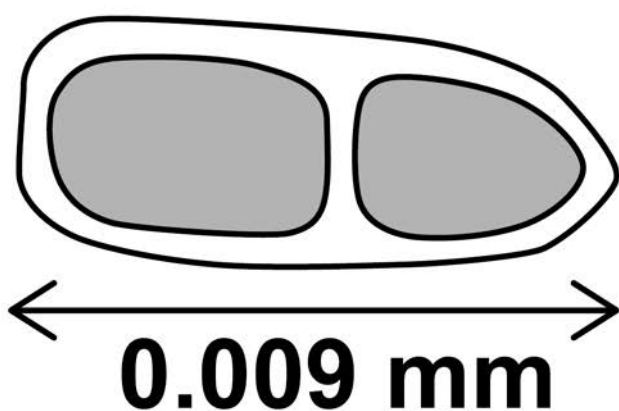
## **FIGURE 6**

The diagram is **NOT** drawn to scale.

### **PLANT CELL**



### **MICROORGANISM**



**Calculate how many times longer the plant cell is than the microorganism that causes rose black spot. [1 mark]**

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**Number of times longer = \_\_\_\_\_**

**[Turn over]**

05.7

**The infected rose bush:**

- has yellow leaves
- is not growing.

**Explain why the rose bush is NOT growing. [4 marks]**

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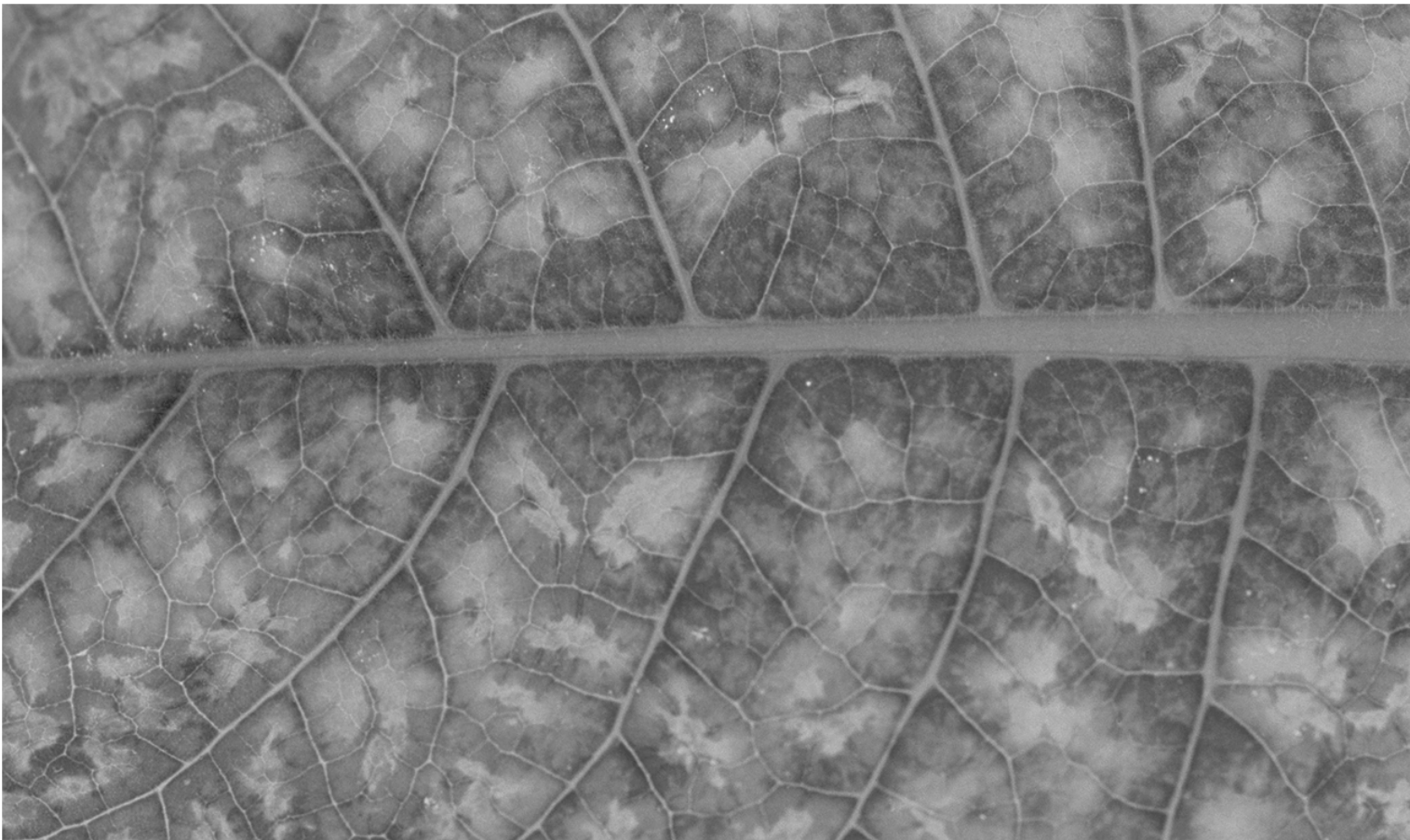
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**FIGURE 7** shows part of a leaf from a tomato plant with a different plant disease.

**FIGURE 7**



**0 5 . 8**

**Name the plant disease shown in  
FIGURE 7. [1 mark]**

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**[Turn over]**

**14**



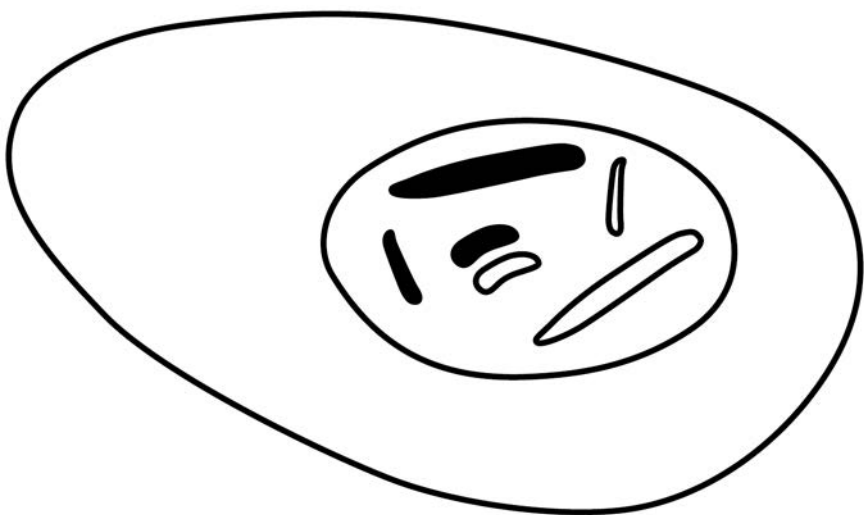
0	6
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**New cells are made by cell division.**

**The body cells of a mosquito each contain six chromosomes.**

**FIGURE 8 shows a body cell of a mosquito.**

**FIGURE 8**



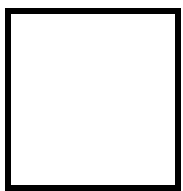
**FIGURE 9, on the opposite page, shows four cells formed from the cell in FIGURE 8.**

06.1

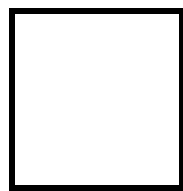
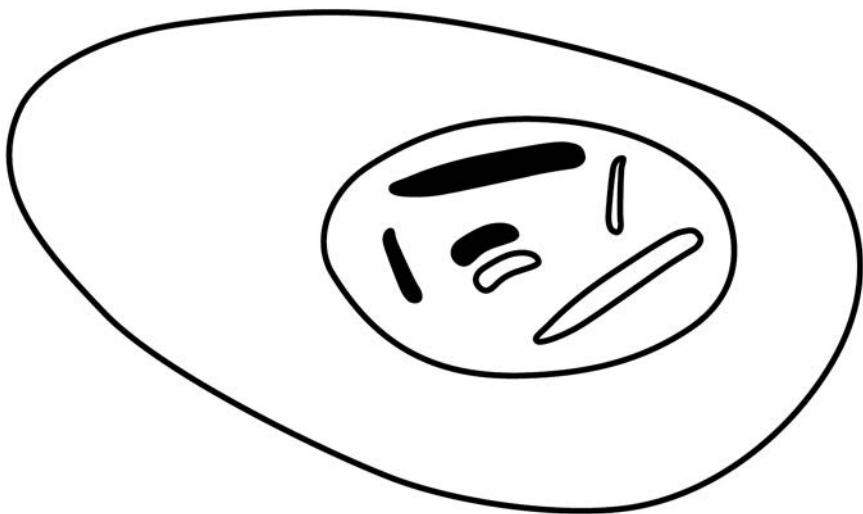
Which cell in FIGURE 9 shows a normal muscle cell from a mosquito? [1 mark]

Tick (✓) ONE box.

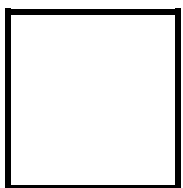
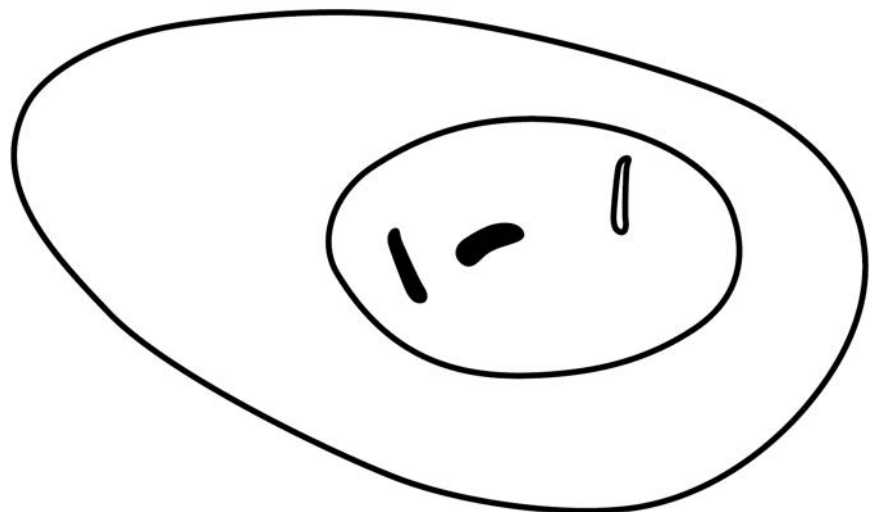
FIGURE 9



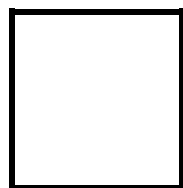
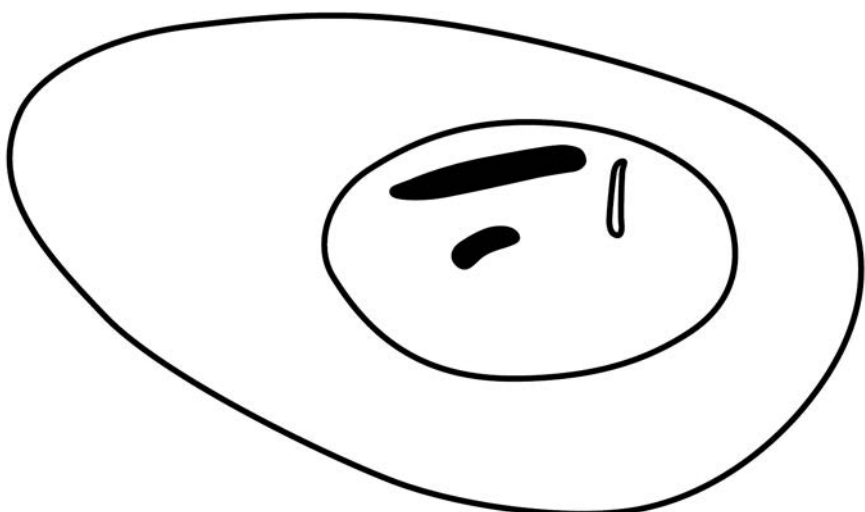
A



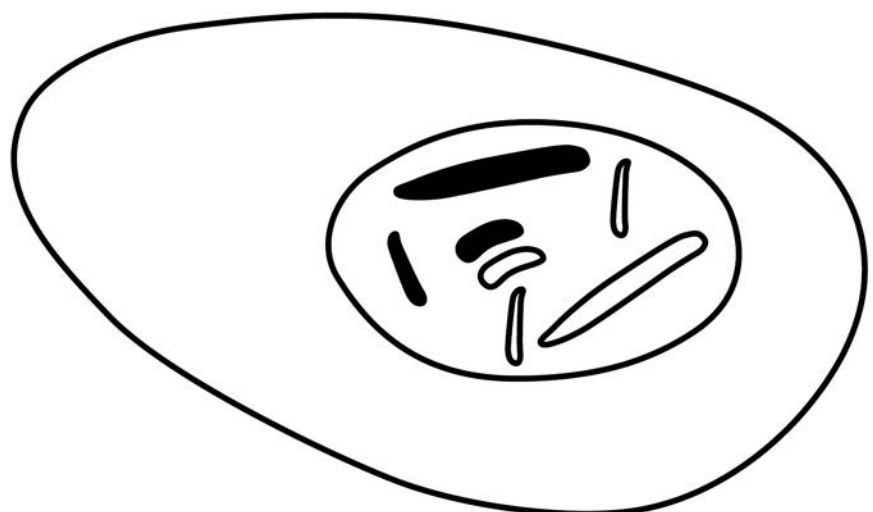
B



C



D



[Turn over]



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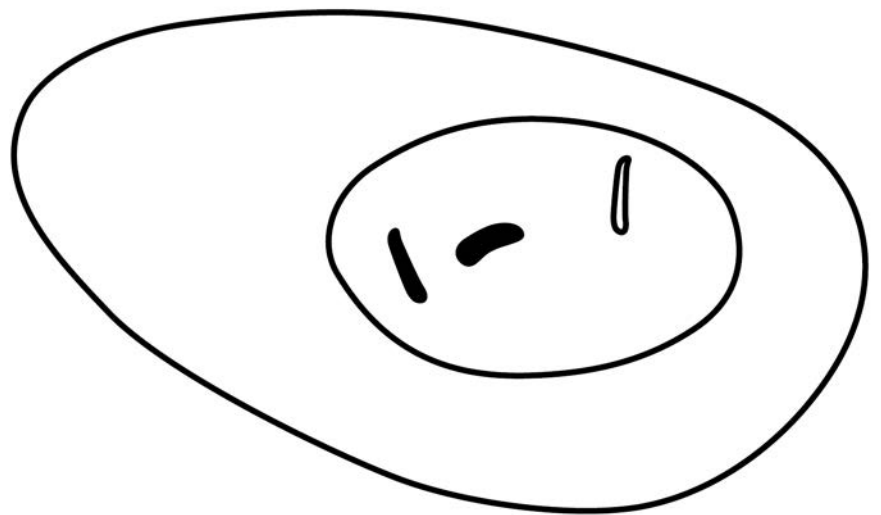
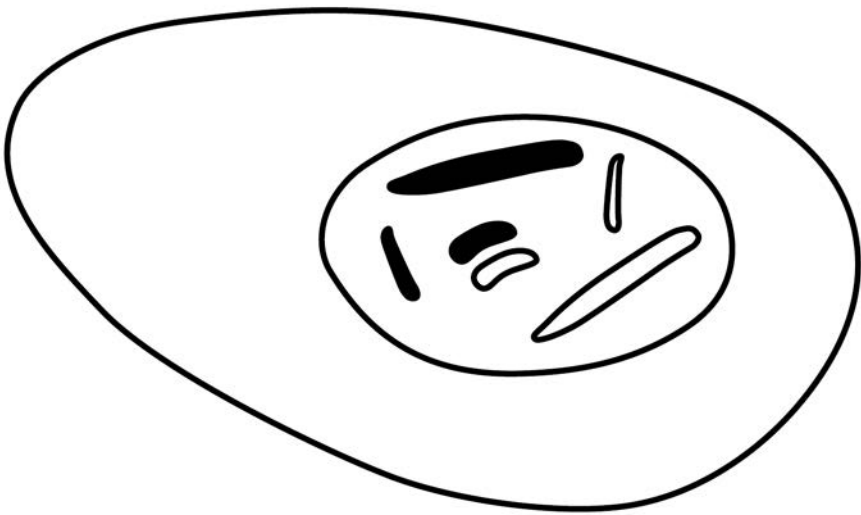
06.2

Which cell in FIGURE 9, repeated below, shows a normal egg cell from a mosquito? [1 mark]

Tick (✓) ONE box.

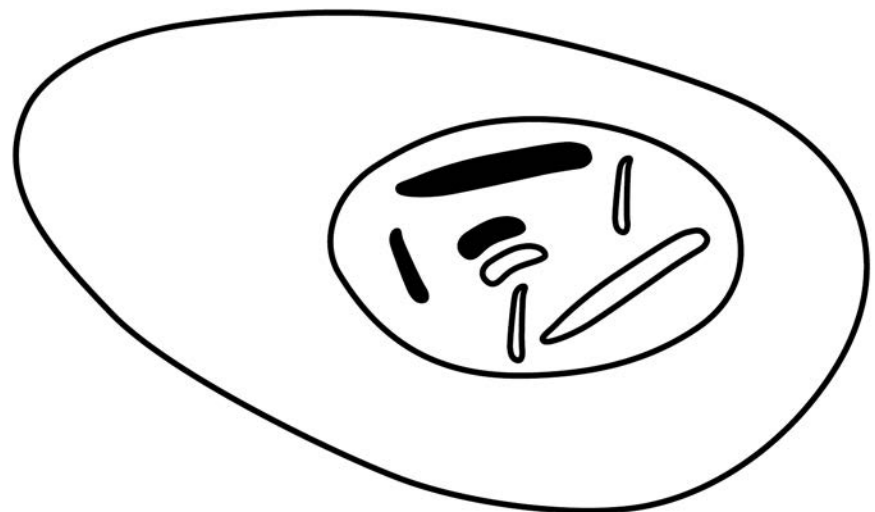
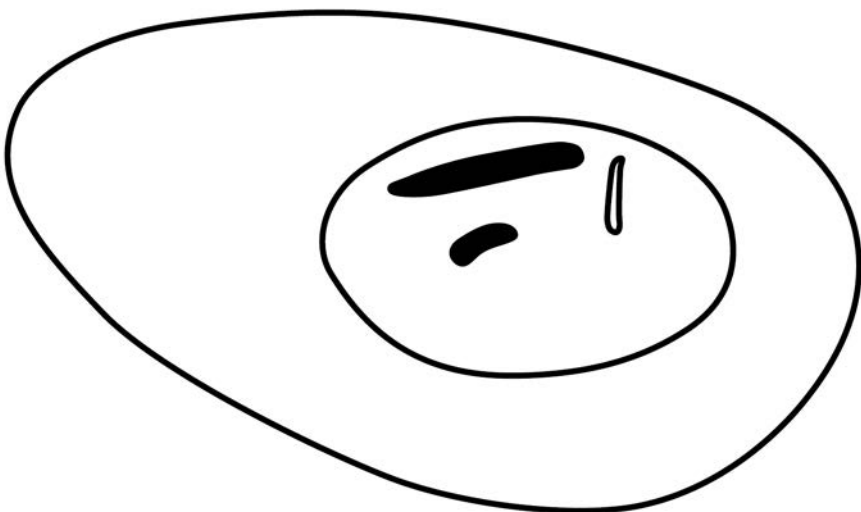
A

B




C

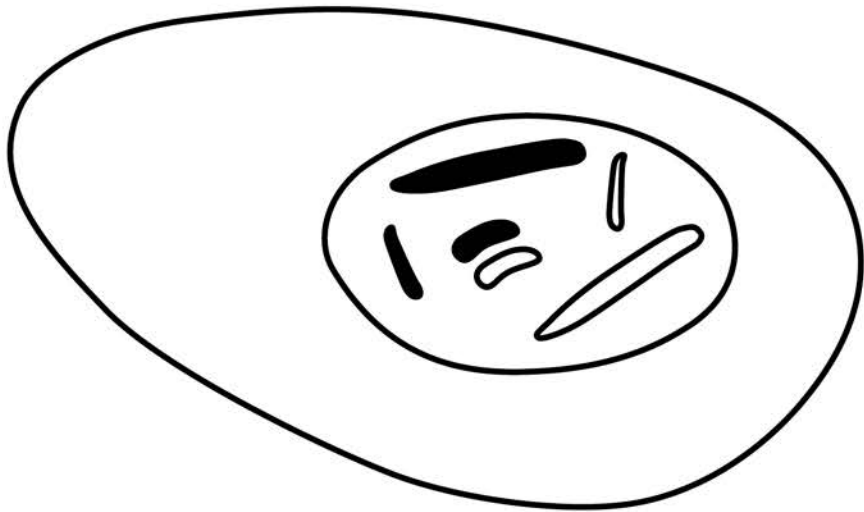
D



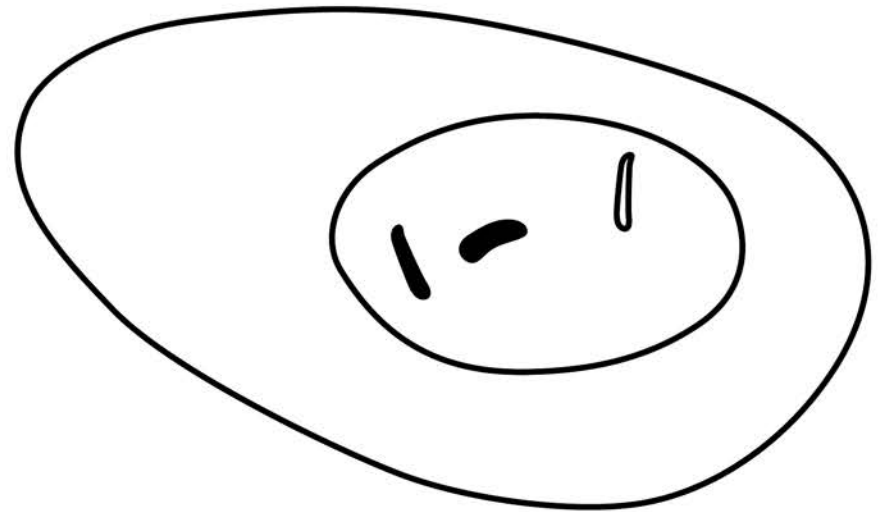
[Turn over]



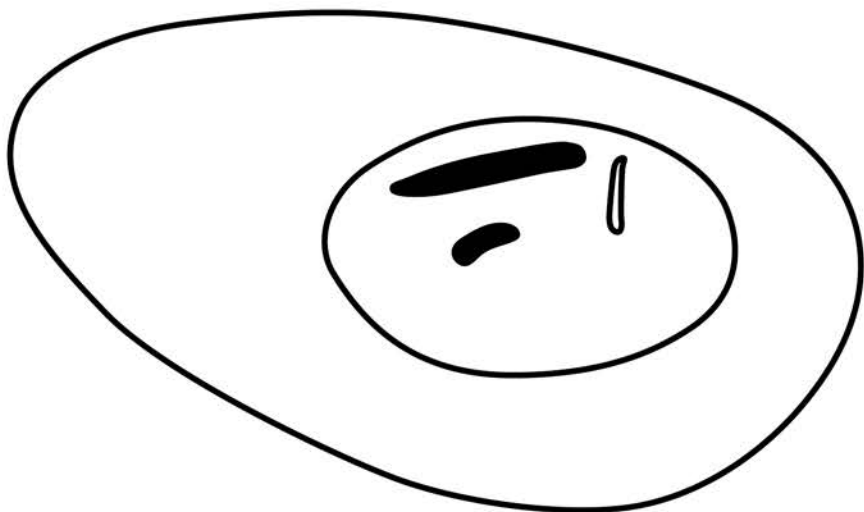
Repeat of FIGURE 9



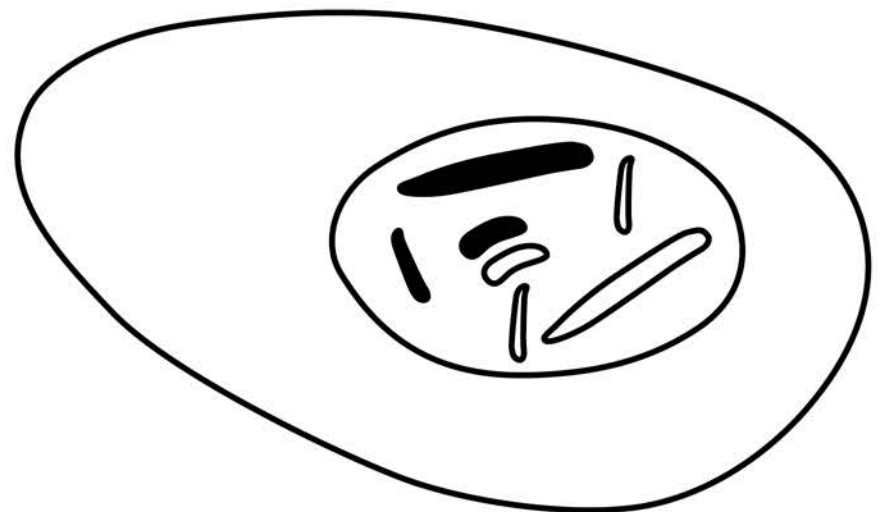
A



B



C



D

06.3

**Which cell in FIGURE 9 shows an abnormal body cell from a mosquito?**

**Give a reason for your answer.**  
**[2 marks]**

**Cell** \_\_\_\_\_

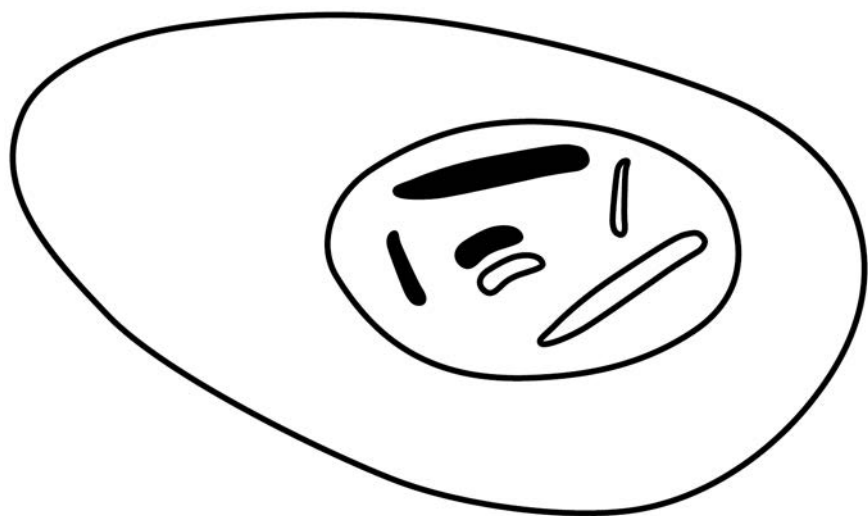
**Reason** \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

**[Turn over]**

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**Repeat of FIGURE 8****06.4**

**Which process would produce cells that are identical to the body cell in FIGURE 8? [1 mark]**

**Tick (✓) ONE box.**

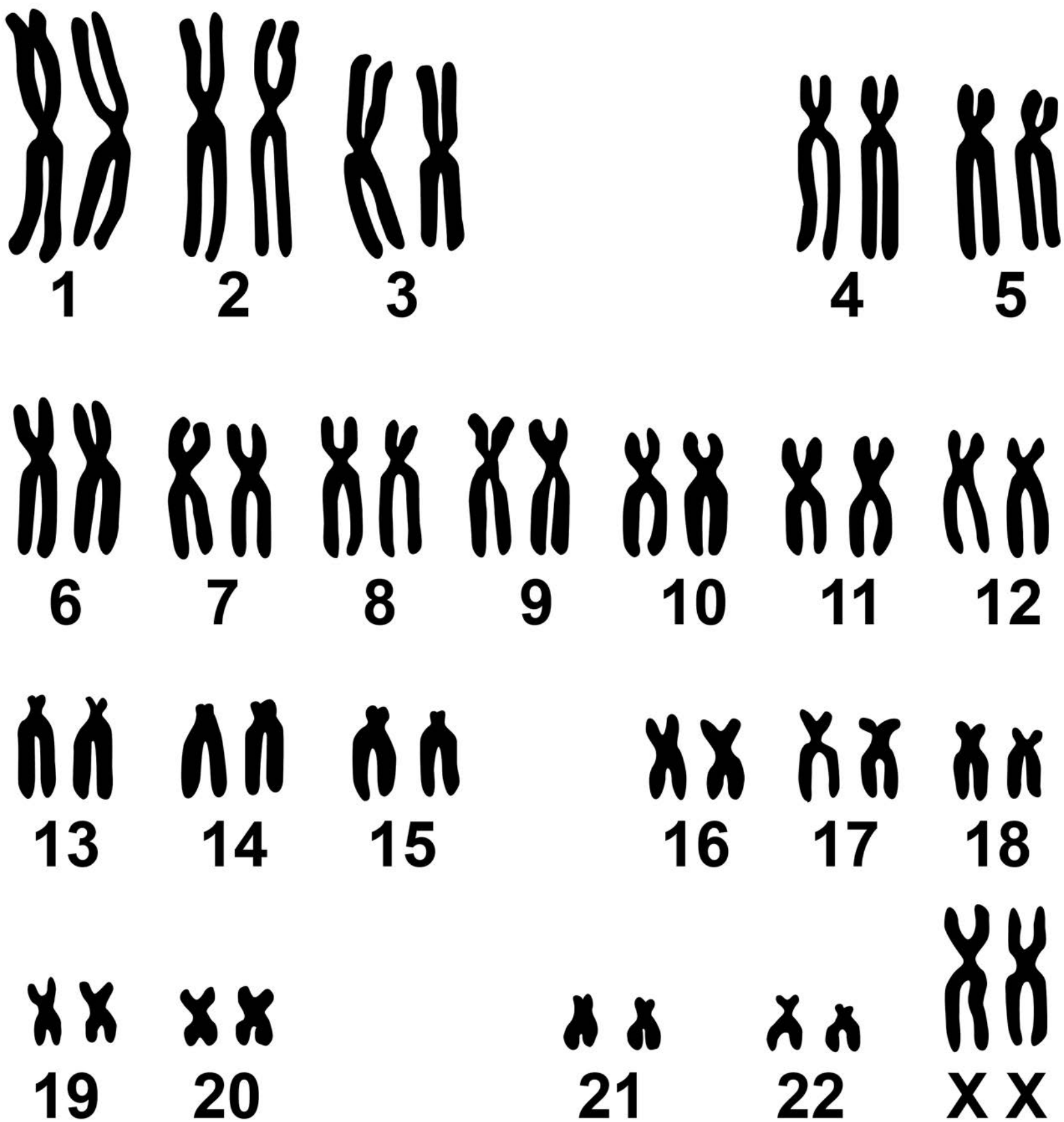
**Evolution****Fertilisation****Meiosis****Mitosis**

**[Turn over]**



06.5

**FIGURE 10** shows the chromosomes from one human body cell.

**FIGURE 10**

**What evidence is there in FIGURE 10 to show that this cell is from a female?  
[1 mark]**

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**[Turn over]**

**Eye colour is an inherited characteristic.**

**Brown eye colour is caused by a dominant allele, B.**

**Blue eye colour is caused by a recessive allele, b.**

**0 6 . 6**

**What is the genotype of a person with blue eyes? [1 mark]**

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**[Turn over]**



**06.7**

**A man with brown eyes and a woman with brown eyes have a child.**

**Complete FIGURE 11 on the opposite page.**

**You should:**

- **show the alleles the child could inherit**
- **include the eye colour for each combination of alleles**
- **give the probability of the child having brown eyes.**

**[4 marks]**

FIGURE 11

		WOMAN	
		B	b
MAN	B	<b>BB</b>  <b>Eye colour:</b> <b>brown</b>	<b>Eye colour:</b> <hr/>
	b	<b>Eye colour:</b> <hr/>	<b>Eye colour:</b> <hr/>

**Probability of child having brown eyes =**

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**[Turn over]**



**06.8**

**Some animals are selectively bred for specific characteristics.**

**FIGURE 12 shows a racing greyhound.**

**FIGURE 12**



The greyhound has been selectively bred to run fast.

Suggest TWO features the greyhound has that enable it to run fast.

Use FIGURE 12. [2 marks]

1

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2

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[Turn over]

13

**07**

**Students in four groups measured their reaction times.**

**TABLE 3 shows the ranges of reaction times for each group.**

**TABLE 3**

<b>Group</b>	<b>Range of reaction times in seconds (s)</b>
<b>A</b>	<b>0.14 – 0.59</b>
<b>B</b>	<b>0.42 – 1.20</b>
<b>C</b>	<b>0.42 – 0.76</b>
<b>D</b>	<b>0.63 – 1.02</b>

0	7	.	1
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**Which group had all their results in the normal range for reaction time?  
[1 mark]**

**Tick (✓) ONE box.**

**A****B****C****D**

**[Turn over]**



0	7	.	2
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**Describe a method to investigate the effect of caffeine on reaction time.**  
**[6 marks]**

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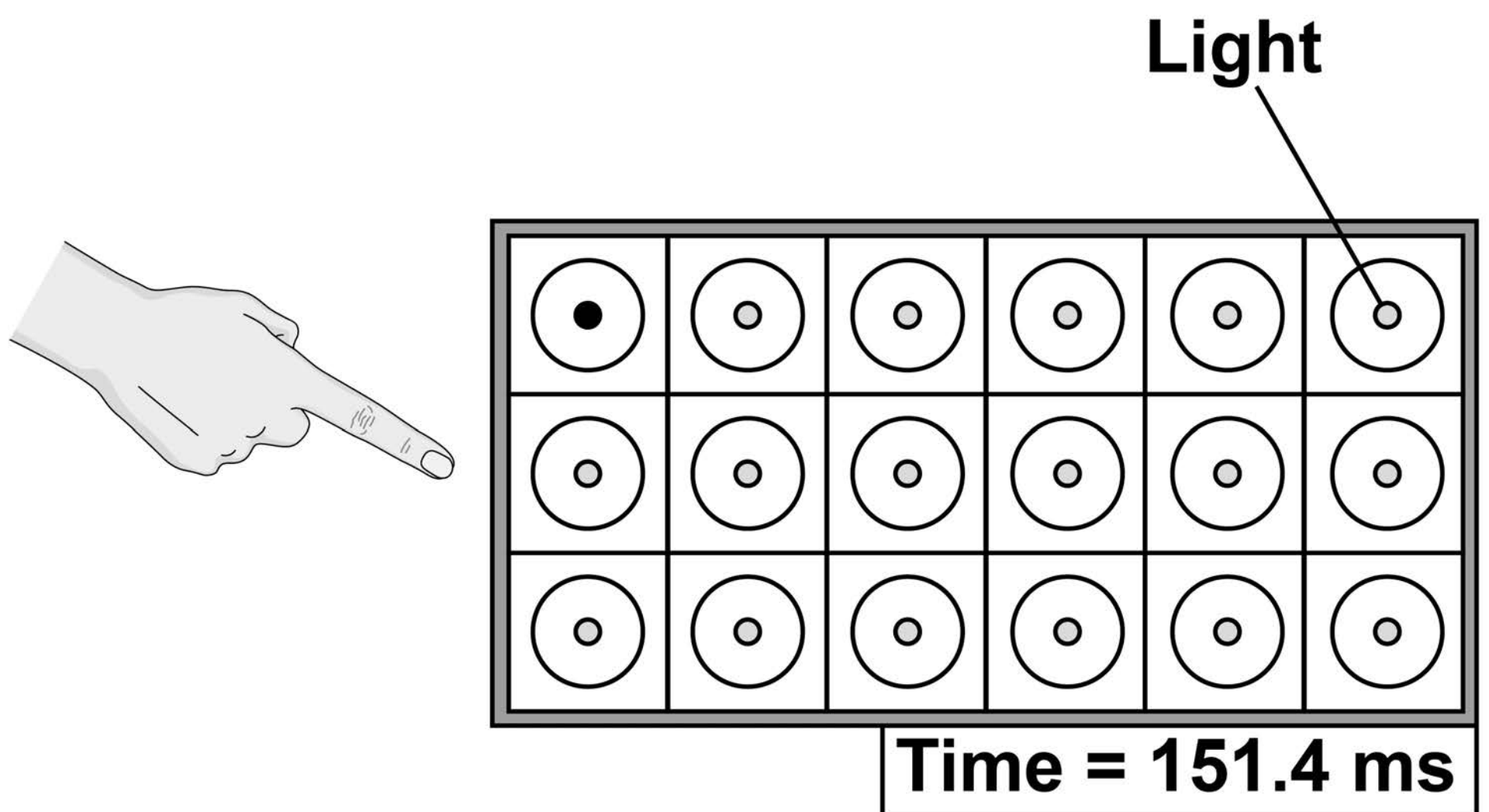
**[Turn over]**



A sports scientist investigated the reaction times of athletes.

**FIGURE 13** shows a light box used by the sports scientist.

**FIGURE 13**



This is the method used.

1. Stand in front of the light box.
2. When a light comes on in a circle, touch the circle as quickly as possible.

3. Record the time taken, as shown on the light box display.
4. Repeat steps 2–3 another four times.

07.3

**Which word describes cells in the eye that detect the light? [1 mark]**

**Tick (✓) ONE box.**

**Coordinators**

**Effectors**

**Receptors**

**Responses**

**[Turn over]**



**The scientist compared the reaction time of a male athlete and a female athlete.**

**07.4**

**Give TWO factors the scientist should have controlled in the investigation.**

**Do NOT refer to caffeine in your answer.  
[2 marks]**

**1**

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**2**

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**[Turn over]**



**TABLE 4 shows the results.**

**TABLE 4**

<b>Reaction time in milliseconds (ms)</b>		
	<b>MALE ATHLETE</b>	<b>FEMALE ATHLETE</b>
<b>TEST 1</b>	<b>153.6</b>	<b>138.2</b>
<b>TEST 2</b>	<b>154.2</b>	<b>145.7</b>
<b>TEST 3</b>	<b>150.0</b>	<b>149.1</b>
<b>TEST 4</b>	<b>151.4</b>	<b>142.9</b>
<b>TEST 5</b>	<b>153.9</b>	<b>140.6</b>



0	7	.	5
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**Which test shows the median reaction time for the female athlete? [1 mark]**

**Tick (✓) ONE box.**

**Test 1**

**Test 2**

**Test 3**

**Test 4**

**Test 5**

**[Turn over]**



**Repeat of TABLE 4**

	<b>Reaction time in milliseconds (ms)</b>	
	<b>MALE ATHLETE</b>	<b>FEMALE ATHLETE</b>
<b>TEST 1</b>	<b>153.6</b>	<b>138.2</b>
<b>TEST 2</b>	<b>154.2</b>	<b>145.7</b>
<b>TEST 3</b>	<b>150.0</b>	<b>149.1</b>
<b>TEST 4</b>	<b>151.4</b>	<b>142.9</b>
<b>TEST 5</b>	<b>153.9</b>	<b>140.6</b>



0	7	.	6
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**Calculate the mean reaction time for the male athlete.**

**Give your answer to 4 significant figures. [2 marks]**

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**Mean reaction time = \_\_\_\_\_ ms**

**[Turn over]**

0	7	.	7
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**The reaction time for the female athlete in test 1 was 138.2 ms**

**Give this reaction time in seconds.  
[1 mark]**

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**Reaction time = \_\_\_\_\_ s**

0	7	.	8
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**Why does repeating the test give more valid results than doing the test only once? [1 mark]**

**Tick (✓) ONE box.**

**Anomalies can be identified**

**Results are reproducible**

**Errors are prevented**

**Results are more precise**

**[Turn over]**

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07.9

**The scientist concluded:**

**‘Female athletes have shorter reaction times than male athletes.’**

**Suggest why this conclusion may NOT be valid. [1 mark]**

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**[Turn over]**

<b>16</b>

08

This question is about carbon dioxide emissions.

TABLE 5 shows information about carbon dioxide emissions in the UK.

TABLE 5

Year	Mass of carbon dioxide in $\text{kg} \times 10^5$		
	Emitted from electricity production	Emitted from paper production	Total emitted from all sources
2006	1263	54	6314
2009	902	32	5575
2012	1258	29	5567
2015	768	27	5043



08.1

**Suggest TWO reasons why carbon dioxide emissions from paper production decreased from 2006 to 2015. [2 marks]**

**1**

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**2**

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**[Turn over]**

0	8	.	2
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**Suggest TWO reasons why carbon dioxide emissions from electricity production decreased from 2012 to 2015. [2 marks]**

**1**

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**2**

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0	8	.	3
---	---	---	---

**Calculate the percentage of the total carbon dioxide emissions in 2006 that was from electricity production.**  
**[2 marks]**

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**Percentage =** \_\_\_\_\_ **%**

**[Turn over]**

0 8 . 4

**Explain the possible consequences of  
a future increase in carbon dioxide  
emissions. [6 marks]**

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**END OF QUESTIONS**

<b>12</b>



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For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
<b>TOTAL</b>	

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