

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

GCSE COMBINED SCIENCE: SYNERGY

F

Foundation Tier Paper 2 Life and environmental sciences

Wednesday 22 May 2019

Afternoon

Time allowed: 1 hour 45 minutes

Materials

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.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided. Do not write outside the box around each page or 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.

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



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

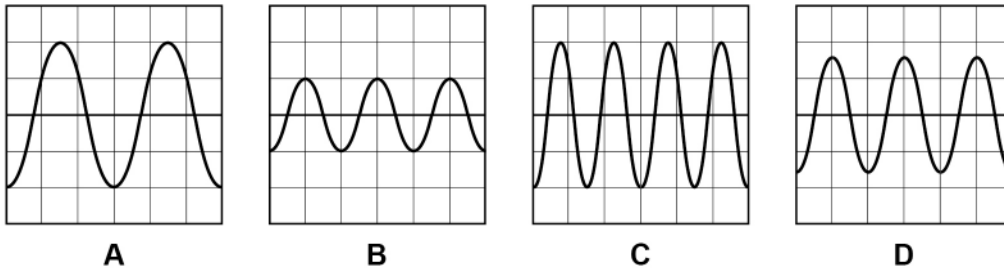
0 1

Figure 1 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.

Figure 1



0 1 . 1

Which wave has the smallest amplitude?

[1 mark]

Tick (✓) **one** box.

A

B

C

D

0 1 . 2

Which wave has the highest frequency?

[1 mark]

Tick (✓) **one** box.

A

B

C

D

0 1 . 3

How many complete wavelengths are shown in wave **A**?

[1 mark]

Number of complete wavelengths = _____



0 1 . 4

Draw **one** line from each quantity associated with a wave to the unit the quantity is measured in.

[3 marks]

Quantity	Unit
frequency	Hz
	m
period	m ³
	m ²
wavelength	s

0 1 . 5

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 = $\frac{\text{wavelength}}{\text{frequency}}$

0 1 . 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

Test	Time taken in seconds
1	0.32
2	0.36
3	0.34
Mean	X

0 1 . 7 Calculate mean value **X** in **Table 1**.

[1 mark]

$$X = \underline{\hspace{2cm}} \text{ s}$$

0 1 . 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]

$$\text{Speed} = \underline{\hspace{2cm}} \text{ m/s}$$



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]

11

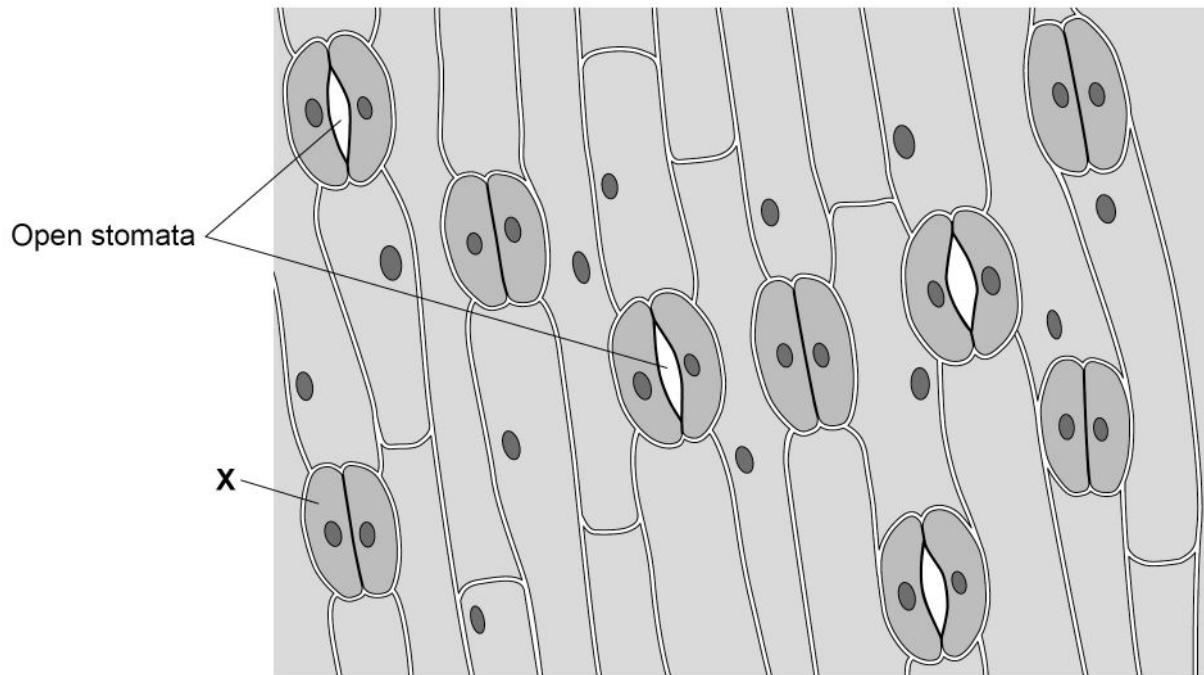
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Turn over ►

0 2

Figure 2 shows part of a plant leaf seen through a microscope.

Figure 2



0 2 . 1

X is a specialised plant cell.

What type of cell is X?

[1 mark]

Tick (✓) **one** box.

Guard cell

Meristem cell

Xylem cell



0 2 . 2 Cell **X** is 0.0083 mm in length.

How long is cell **X** in micrometres (μm)?

1 mm = 1000 μm

[1 mark]

Tick (✓) **one** box.

0.000083 μm

0.083 μm

0.83 μm

8.3 μm

0 2 . 3 Calculate the percentage of stomata that are open in **Figure 2**.

[2 marks]

Percentage = _____ %

0 2 . 4 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

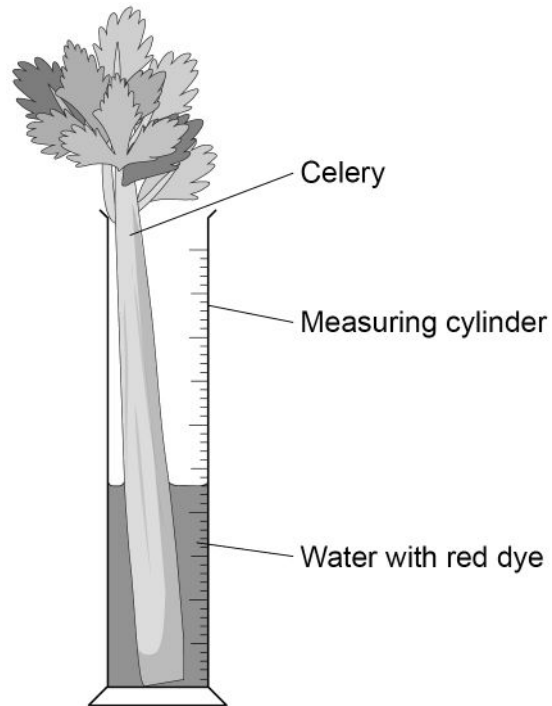
Turn over ►



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]



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]

0 2 . 7 Give **two** ways a student could increase the rate of water uptake of a plant in a school laboratory.

[2 marks]

1 _____

2 _____

12

Turn over for the next question

Turn over ►



0 3

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

0 3 . 1

Give **three** conclusions about food **D**.

[3 marks]

- 1 _____

- 2 _____

- 3 _____

0 3 . 2

Starch is broken down into glucose.

Which type of enzyme breaks down starch?

[1 mark]

Tick (✓) **one** box.

Carbohydrase

Lipase

Protease



0 3 . 3 Which part of a cell releases energy from glucose?

[1 mark]

Tick (✓) **one** box.

Mitochondria

Nucleus

Ribosomes

Vacuole

0 3 . 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 _____

8

Turn over for the next question

Turn over ►



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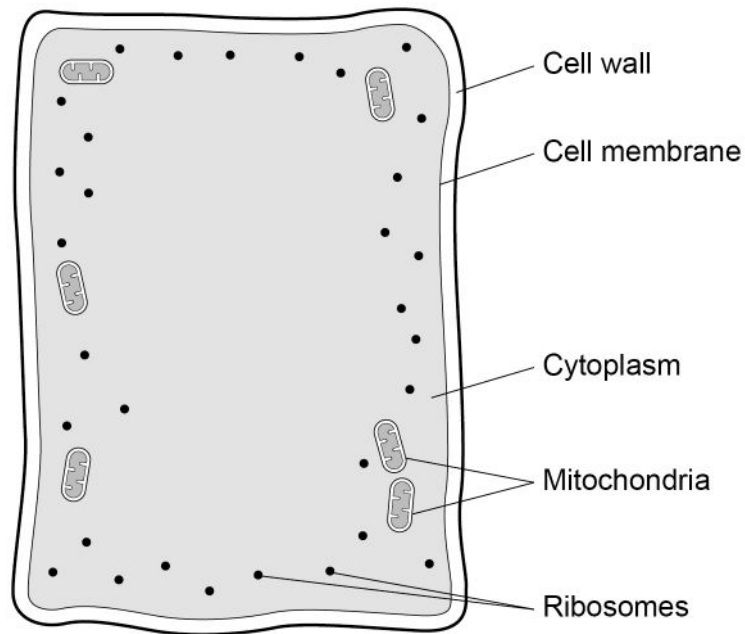
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0 4

Figure 4 shows some parts of a plant leaf cell.

Figure 4



0 4 . 1

Name **three** parts of a plant leaf cell that are missing from **Figure 4**.

[3 marks]

- 1 _____
- 2 _____
- 3 _____

0 4 . 2

What is the function of the cell wall in a plant cell?

[1 mark]

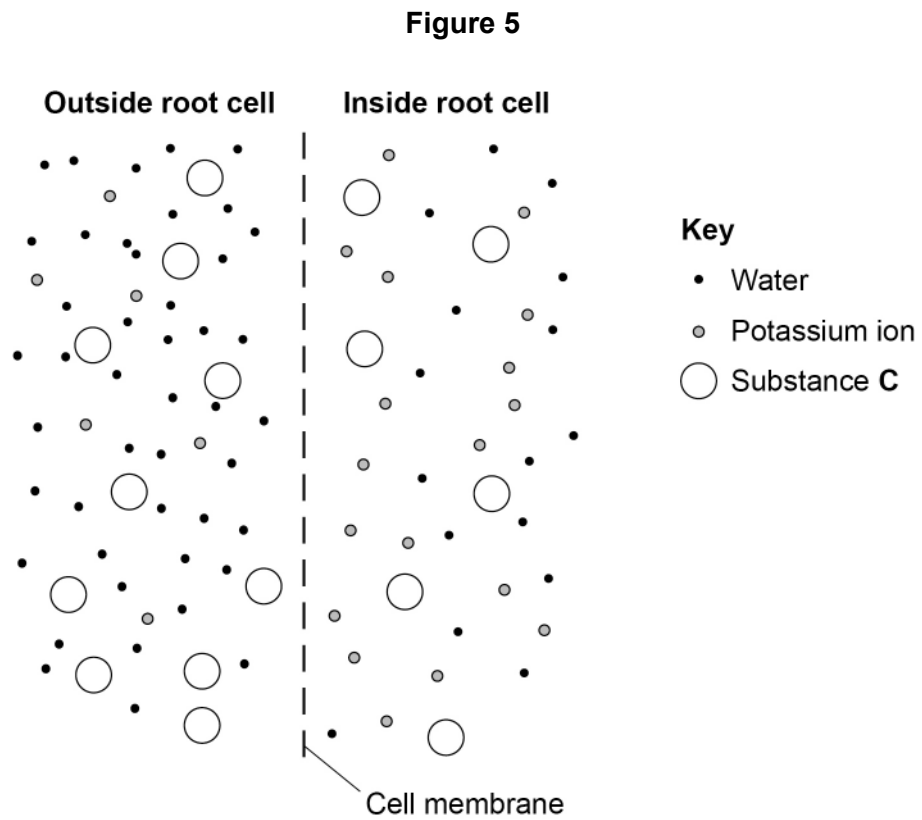
Question 4 continues on the next page

Turn over ►



Root cells absorb substances from the soil.

Figure 5 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



0 4 . 4 How does water move into the root cell in **Figure 5**?

[1 mark]

Tick (✓) **one** box.

By active transport

By evaporation

By osmosis

0 4 . 5 How do potassium ions move into the root cell in **Figure 5**?

[1 mark]

Tick (✓) **one** box.

By active transport

By diffusion

By osmosis

0 4 . 6 Explain why substance **C** in **Figure 5** does **not** move into the root cell.

[2 marks]

Question 4 continues on the next page

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.

0 4 . 7

Give **three** factors the student should control in the investigation.

[3 marks]

1 _____

2 _____

3 _____

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

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

14

Turn over for the next question

Turn over ►



0 5 Plants can photosynthesise.

0 5 . 1 Complete the word equation for photosynthesis.

[1 mark]

carbon dioxide + water \longrightarrow glucose + _____

0 5 . 2 Light is needed for photosynthesis.

Name the green pigment that absorbs light for photosynthesis.

[1 mark]

0 5 . 3 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 _____ .



A rose bush has a disease called rose black spot.

0 5 . 4 What type of microorganism causes rose black spot?

[1 mark]

Tick (✓) **one** box.

Bacterium

Fungus

Protist

Virus

0 5 . 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

Question 5 continues on the next page

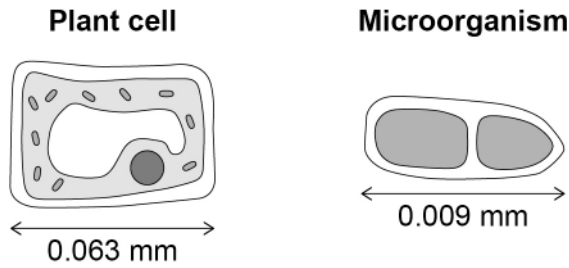
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0 5 . 6

Figure 6 shows a plant cell and the microorganism that causes rose black spot.

Figure 6



Not to scale

Calculate how many times longer the plant cell is than the microorganism that causes rose black spot.

[1 mark]

Number of times longer = _____

0 5 . 7

The infected rose bush:

- has yellow leaves
- is not growing.

Explain why the rose bush is **not** growing.

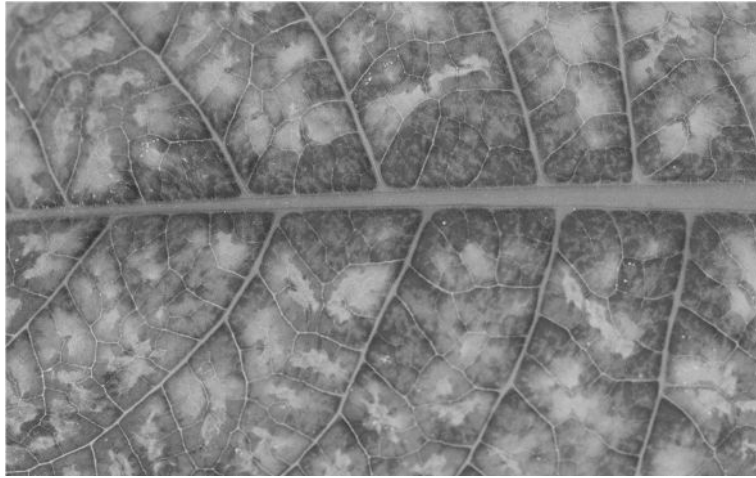
[4 marks]



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

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outside the
box*

Figure 7



0 5 . 8 Name the plant disease shown in **Figure 7**.

[1 mark]

14

Turn over for the next question

Turn over ►



0 6

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

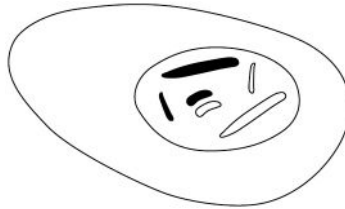
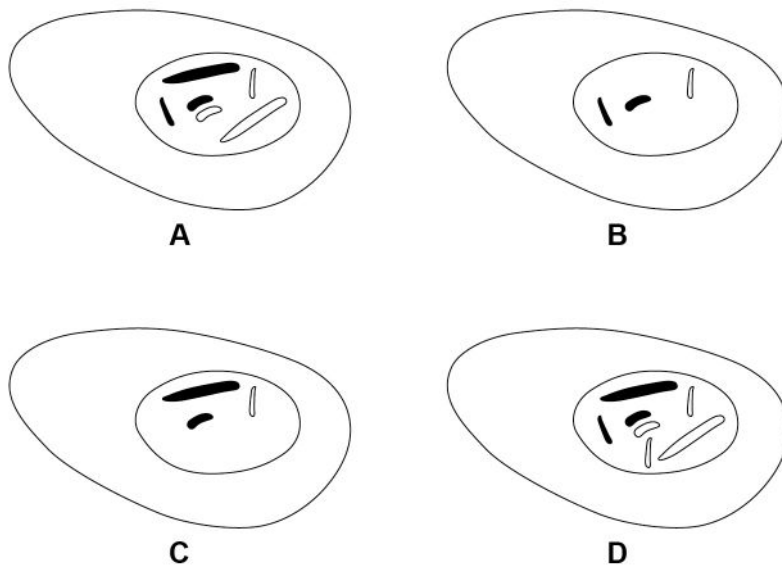


Figure 9 shows four cells formed from the cell in **Figure 8**.

Figure 9



0 6 . 1

Which cell in **Figure 9** shows a normal muscle cell from a mosquito?

[1 mark]

Tick (✓) **one** box.

A

B

C

D



0 6 . 2 Which cell in **Figure 9** shows a normal egg cell from a mosquito?

[1 mark]

Tick (✓) **one** box.

A	B	C	D
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

0 6 . 3 Which cell in **Figure 9** shows an abnormal body cell from a mosquito?

Give a reason for your answer.

[2 marks]

Cell _____

Reason _____

0 6 . 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

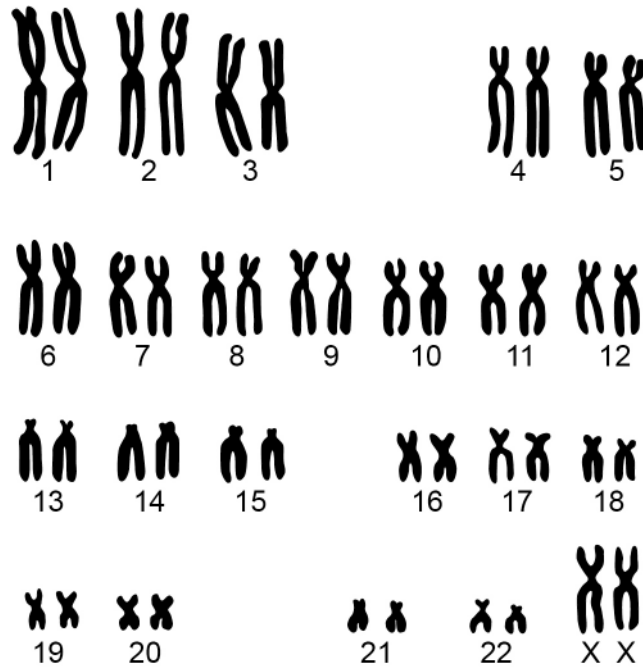
Question 6 continues on the next page

Turn over ►



0 6 . 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]



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]

0 6 . 7

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

Complete **Figure 11**.

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	BB Eye colour: brown	Eye colour: _____
	b	Eye colour: _____	Eye colour: _____

Probability of child having brown eyes = _____

Question 6 continues on the next page

Turn over ►



0 6 . 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 _____

2 _____

13



0 7

Students in four groups measured their reaction times.

Table 3 shows the ranges of reaction times for each group.

Table 3

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

0 7

1

Which group had all their results in the normal range for reaction time?

[1 mark]

Tick (✓) **one** box.

A

B

C

D

Question 7 continues on the next page

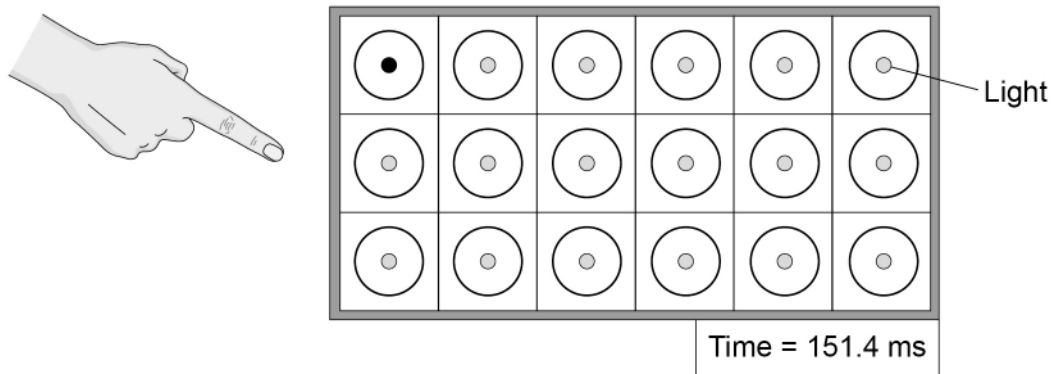
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A sports scientist investigated the reaction times of athletes.

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.

0 7 . 3 Which word describes cells in the eye that detect the light?

[1 mark]

Tick (✓) **one** box.

Coordinators

Effectors

Receptors

Responses

Question 7 continues on the next page

Turn over ►



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

0 7 . 4 Give **two** factors the scientist should have controlled in the investigation.

Do **not** refer to caffeine in your answer.

[2 marks]

1 _____

2 _____

Table 4 shows the results.

Table 4

	Reaction time in milliseconds (ms)	
	Male athlete	Female athlete
Test 1	153.6	138.2
Test 2	154.2	145.7
Test 3	150.0	149.1
Test 4	151.4	142.9
Test 5	153.9	140.6

0 7 . 5 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



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

Give your answer to 4 significant figures.

[2 marks]

Mean reaction time = _____ ms

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

Give this reaction time in seconds.

[1 mark]

Reaction time = _____ s

0 7 . 8 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

0 7 . 9 The scientist concluded:

'Female athletes have shorter reaction times than male athletes.'

Suggest why this conclusion may **not** be valid.

[1 mark]



0 8

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

0 8 . 1Suggest **two** reasons why carbon dioxide emissions from paper production decreased from 2006 to 2015.**[2 marks]**

1 _____

2 _____

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

1 _____

2 _____



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3 6



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