

## Tuesday 16 May 2023 – Morning

### GCSE (9–1) Combined Science (Biology) A (Gateway Science)

J250/07 Paper 7 (Higher Tier)

Time allowed: 1 hour 10 minutes



**You must have:**

- a ruler (cm/mm)

**You can use:**

- a scientific or graphical calculator
- an HB pencil



Please write clearly in black ink. **Do not write in the barcodes.**

Centre number

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Candidate number

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First name(s)

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Last name

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#### INSTRUCTIONS

- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.

#### INFORMATION

- The total mark for this paper is **60**.
- The marks for each question are shown in brackets [ ].
- Quality of extended response will be assessed in questions marked with an asterisk (\*).
- This document has **24** pages.

#### ADVICE

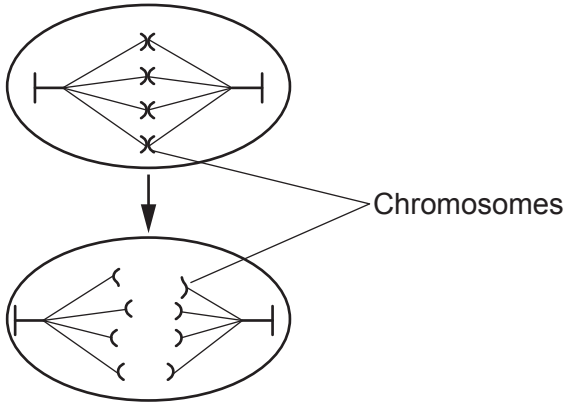
- Read each question carefully before you start your answer.

## Section A

You should spend a **maximum of 20 minutes** on this section.

Write your answer to each question in the box provided.

- 1 Which stage of the cell cycle is represented in the diagram?



- A Differentiation of cell  
 B DNA replication  
 C Growth of cell  
 D Movement of chromosomes

Your answer

[1]

- 2 Which method of contraception is the **most** effective?

Method of contraception	Females who became pregnant while using the method of contraception (%)
A	1
B	8
C	9
D	18

Your answer

[1]

3 What are plasmids?

- A Genetic material found in the cytoplasm of a eukaryotic cell.
- B Genetic material found in the cytoplasm of a prokaryotic cell.
- C Genetic material found in the nucleus of a eukaryotic cell.
- D Genetic material found in the nucleus of a prokaryotic cell.

Your answer

[1]

4 Which row correctly describes a protein?

	Structure	Acid it is made from
A	monomer	amino acids
B	monomer	fatty acids
C	polymer	amino acids
D	polymer	fatty acids

Your answer

[1]

5 A student measures the effect of light intensity on photosynthesis. They place a lamp at different distances from pondweed in a beaker of water.

The student uses the inverse square law to calculate the relative light intensity.

$$\text{Relative light intensity} = \frac{1}{(\text{distance from light source})^2}$$

What is the distance of the lamp from the beaker when the relative light intensity is 4.00?

- A 0.2 m
- B 0.3 m
- C 0.4 m
- D 0.5 m

Your answer

[1]

6 What is one advantage of a light microscope compared to an electron microscope?

- A Only light microscopes are able to observe live specimens.
- B Only light microscopes are able to use stains.
- C Light microscopes have a greater magnification.
- D Light microscopes have a greater resolution.

Your answer

[1]

7 The table shows the sizes of different cells.

Cell	1	2	3	4	5	6	7	8	9
Size (mm)	0.4	0.6	0.4	0.5	0.3	0.4	0.6	0.5	0.3

Which statement about the results is correct?

- A The mode and the median size are both 0.3.
- B The mode and the median size are both 0.4.
- C The mode is 0.3 and the median is 0.0.
- D The mode is 0.4 and the median is 0.3.

Your answer

[1]

8 Which sentence describes one function of translocation?

- A The transport of mineral ions from the leaf to the meristem.
- B The transport of mineral ions from the meristem to the leaf.
- C The transport of sugars from the leaf to the meristem.
- D The transport of sugars from the meristem to the leaf.

Your answer

[1]

9 Which row shows correct information about cell membranes?

	Contains receptor molecules	Forms a selective barrier	Found in eukaryotic cells	Found in prokaryotic cells
A		✓	✓	✓
B	✓	✓	✓	✓
C	✓	✓		✓
D	✓		✓	

Your answer

[1]

10 Which two hormones can be used in contraceptive pills to prevent ovulation during the menstrual cycle?

- A LH and FSH
- B LH and progesterone
- C Oestrogen and FSH
- D Oestrogen and progesterone

Your answer

[1]

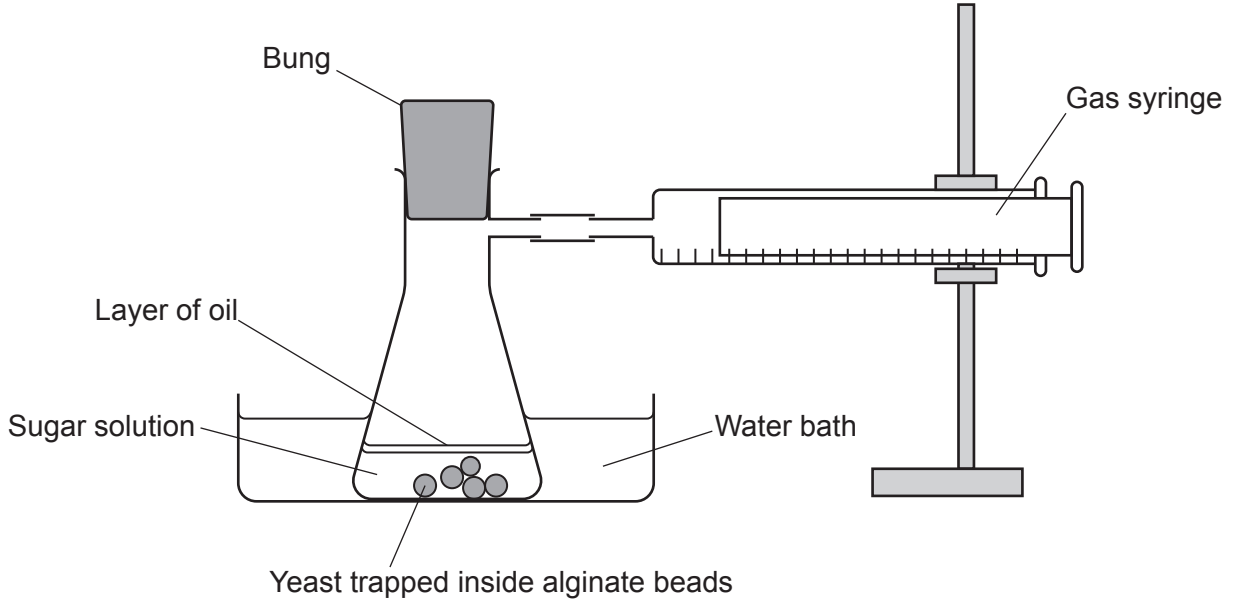
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7  
Section B

11 A scientist investigates the effect of temperature on anaerobic respiration in yeast.

The diagram shows the apparatus they use.



This is the method they follow:

- Collect the gas produced by the yeast for five minutes.
- Increase the temperature of the water bath.
- Repeat the investigation with fresh sugar solution.
- Do each temperature three times.

(a) (i) Suggest why the scientist used fresh **sugar** solution each time.

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

(ii) Identify **one** variable the scientist should keep constant throughout the experiment.

Tick (✓) **one** box.

- |  |                          |
|--|--------------------------|
| Number of alginate beads                 | <input type="checkbox"/> |
| Position of the gas syringe at the start | <input type="checkbox"/> |
| Temperature of the water bath            | <input type="checkbox"/> |
| Volume of gas collected                  | <input type="checkbox"/> |

[1]

(iii) Which gas is collected by the scientist in the gas syringe?

..... [1]

(b) The table shows the scientist's results.

Temperature of water bath (°C)	Volume of gas collected (cm <sup>3</sup> )			
	Trial 1	Trial 2	Trial 3	Mean
15	5	6	6	6
25	14	16	16	15
35	23	26	24	24
45	1	3	2	2
55	6	1	1	1

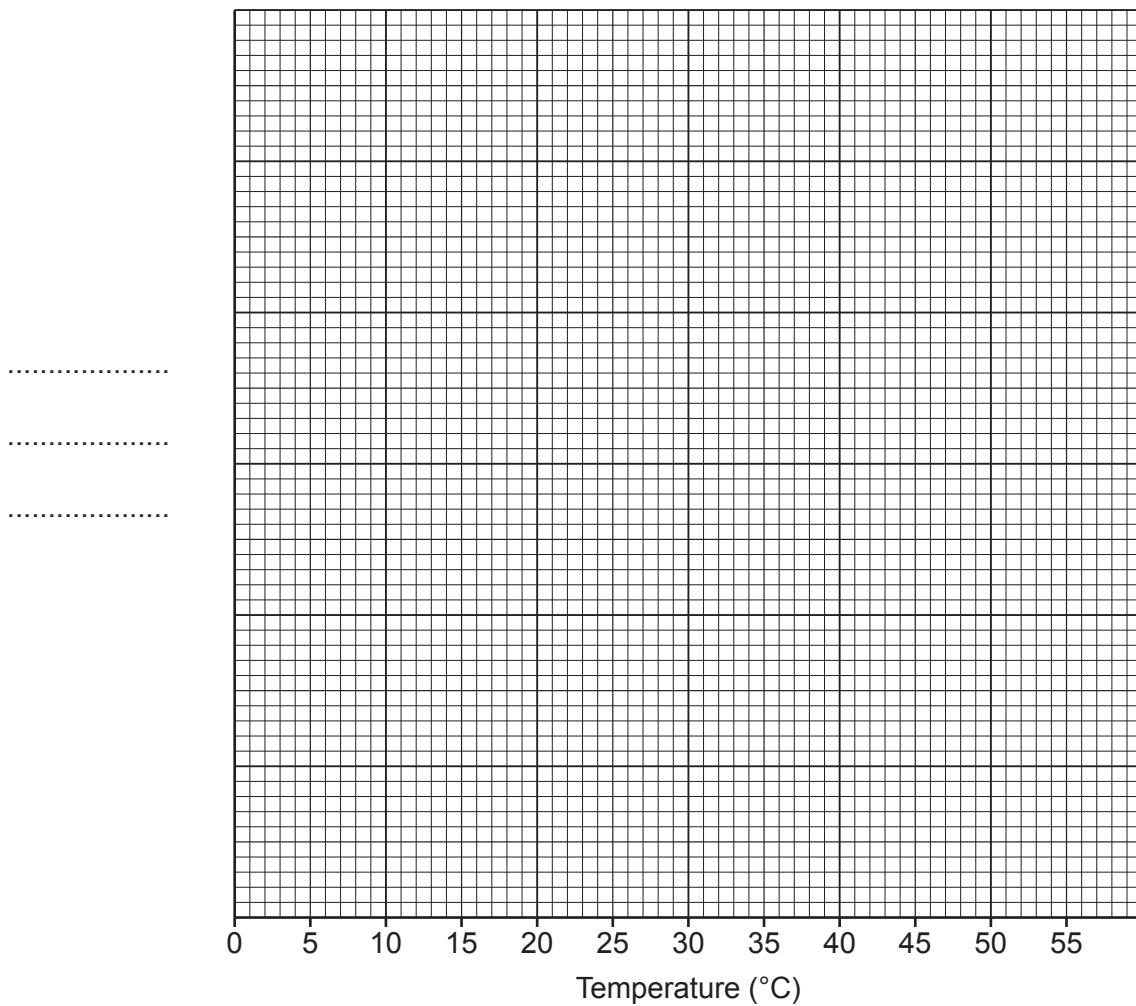
(i) When calculating the mean for 55 °C, they did **not** include Trial 1.

Give the reason why.

..... [1]

(ii) Plot the mean values from the table on the graph. [3]

(iii) Draw a curve of best fit. [1]





(iv) Anaerobic respiration is an enzyme-controlled reaction.

Explain the results between **15°C and 35°C**.  
Include ideas about enzyme particles.

.....

.....

.....

..... [2]

(v) The scientist concludes that the best temperature for anaerobic respiration is approximately 40°C.

How could they alter their investigation to identify a more **accurate** temperature?

.....

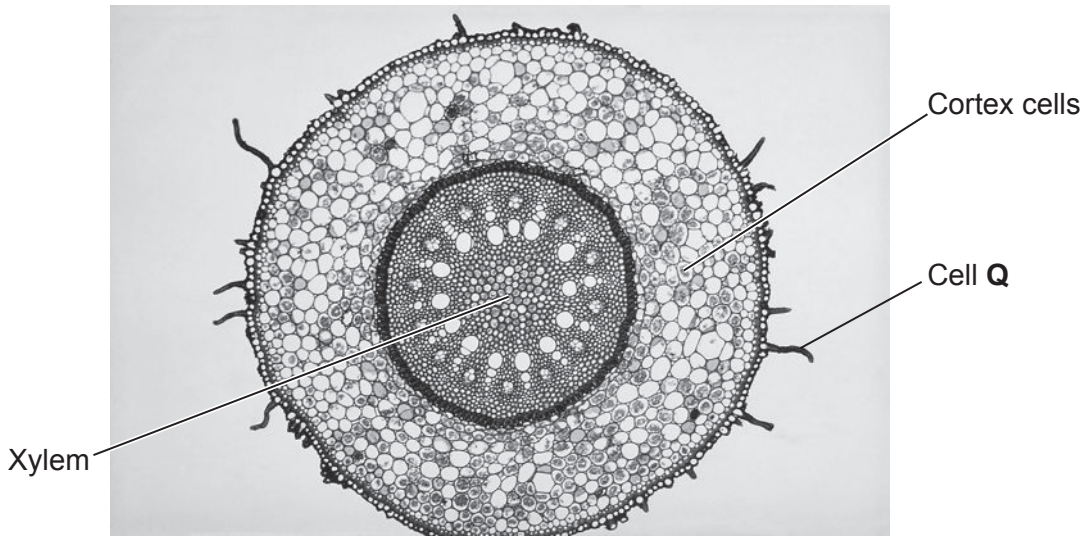
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..... [2]

**10**  
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12 (a) The photograph shows a cross section of a root seen with a light microscope.



(i) The function of cell Q in the photograph is the uptake of water.

Explain how the structure of cell Q is adapted to this function.

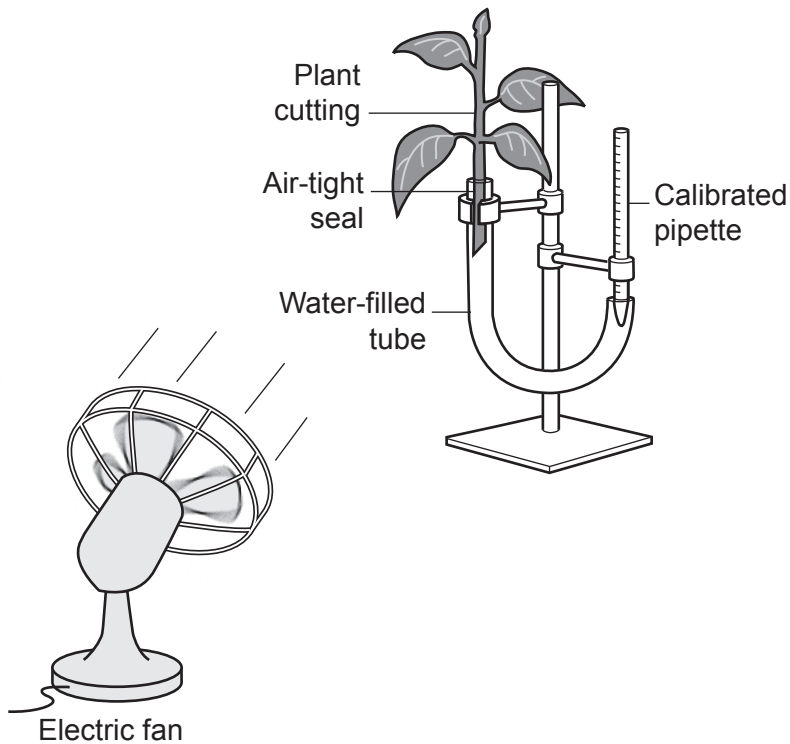
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..... [2]

(ii) Explain how the water moves through the root from cell Q to the xylem. Include ideas about water potential.

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

- (b) A student investigates the effect of air movement on the rate of water uptake using a plant cutting.

The diagram shows the apparatus they use.



This is the method they follow:

- Measure the level of water in the calibrated pipette.
- Switch on the fan and record the level of water again after 30 minutes.
- Repeat investigation with the fan switched off.

The table shows their results.

	Level of water in calibrated pipette (cm <sup>3</sup> )			Rate of water uptake (cm <sup>3</sup> /min)
	At the start	After 30 minutes	Change in level	
<b>Electric fan on</b>	30	7	23	0.8
<b>Electric fan off</b>	32			0.2

- (i) Explain the effect of turning **on** the electric fan upon the rate of water uptake shown in the table.

.....

.....

..... [2]

- (ii) The rate of water uptake when the electric fan is turned **off** is  $0.2 \text{ cm}^3/\text{min}$ .

Use this rate to calculate the level of water after 30 minutes when the fan is switched off.

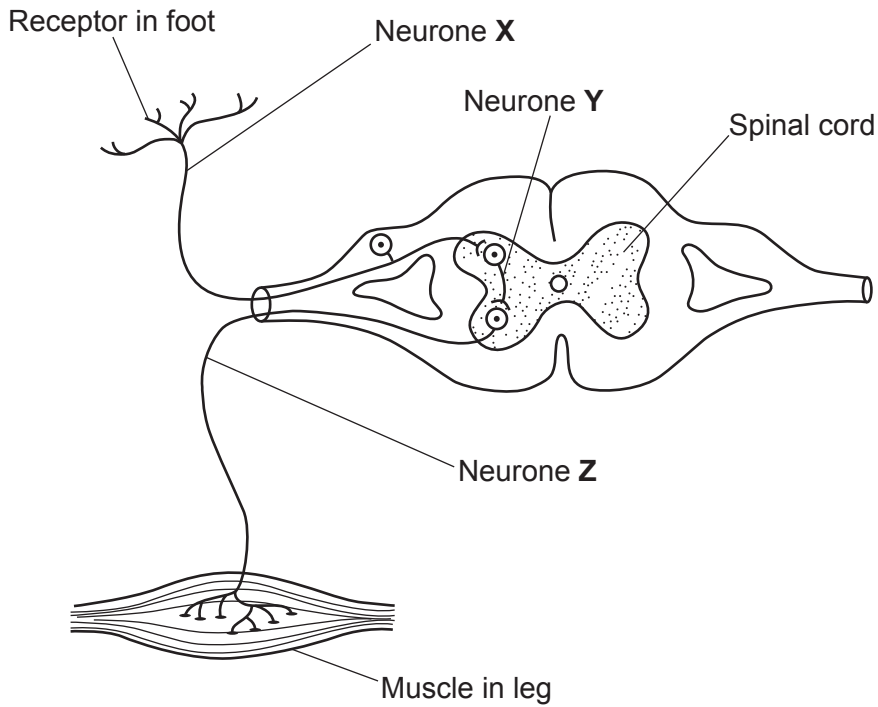
(The value for this rate has **not** been rounded in any way.)

Level of water after 30 minutes = .....  $\text{cm}^3$  [2]

- (iii) Suggest how the student could develop their investigation to explore the effect of changing the **speed** of air movement.

..... [1]

13 (a) The diagram shows a reflex arc.



(i) Draw lines to connect the letters, X, Y and Z, to the **correct name** of each neurone.

X

Motor

Y

Relay

Z

Sensory

[1]

(ii) The foot steps on a sharp object. The leg is pulled away from the sharp object.

Explain how the reflex arc in the diagram produces this response.

.....

.....

..... [2]

(b) The body is also controlled by the endocrine system.

Adrenaline and thyroxine are both hormones.

Compare the roles of adrenaline and thyroxine in the body.

.....

.....

.....

.....

..... [3]

(c) A scientist investigates the effect of glucose on insulin levels in the blood.

They drink glucose dissolved in water. They then measure the level of insulin in their blood.

The table shows their results.

Time after glucose intake (min)	Blood insulin level (mmol/l)
0	165
30	1540
60	1867
90	980
120	160

Explain the change in blood insulin levels between **90 and 120** minutes.

.....

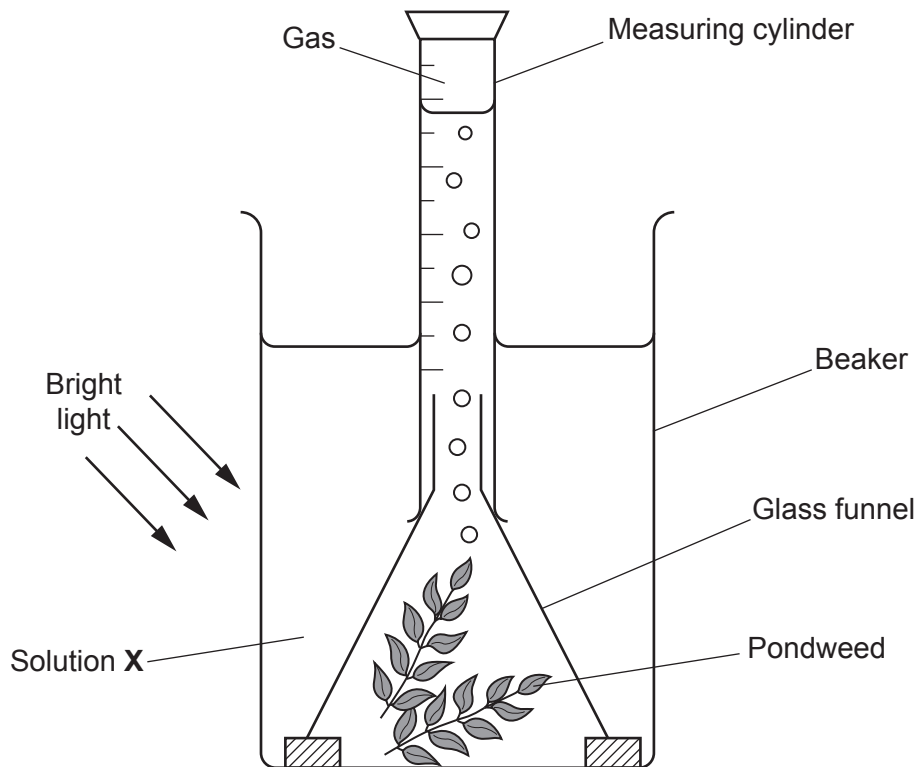
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.....

..... [2]

- 14 (a) A student investigates the availability of carbon dioxide on the rate of photosynthesis. They use a measuring cylinder to measure the volume of gas collected in 20 minutes.

The diagram shows the apparatus they use.



- (i) Solution X contains a chemical that releases carbon dioxide.

Suggest how solution X could be used to change the availability of carbon dioxide.

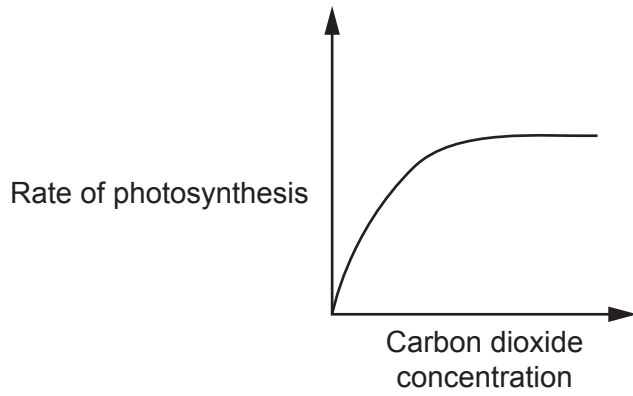
..... [1]

- (ii) What is the **dependent** variable for this investigation?

..... [1]



(b) The student sketches this graph to show their results.



Explain the pattern in the graph.

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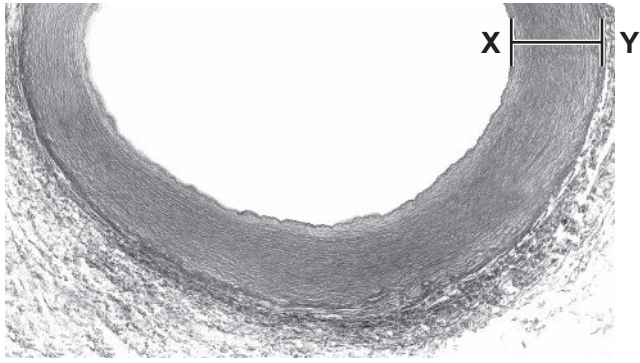
.....

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..... [2]



(b) The photograph shows part of an artery seen using a light microscope.



The image has been magnified 8 times.

Calculate the actual thickness of the artery between points **X** and **Y** in  $\mu\text{m}$ .

Give your answer in **standard form**.

Actual size = .....  $\mu\text{m}$  [3]

(c) Explain how the structure of a **vein** is adapted to its function.

.....

.....

.....

..... [2]

16 Adult stem cells found in skin usually only form new skin cells.

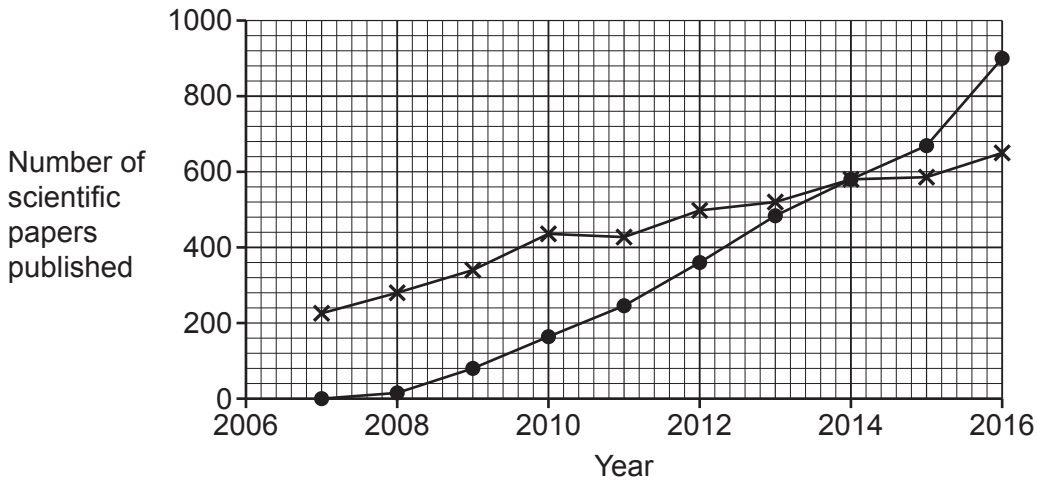
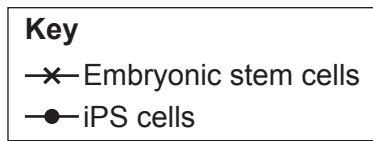
- Scientists have developed adult skin cells that can be reprogrammed into ‘embryonic – like’ stem cells.
- These stem cells are called iPS cells and they can be used as a source of any human cell.

(a) Which process turns stem cells into specialised skin cells?

..... [1]

(b) Both embryonic stem cells and iPS cells are used in medical research.

The graph shows the number of scientific papers published by scientists who have used either embryonic stem cells or iPS cells in their research.



(i) Give **one** reason why it is important for scientists to publish their research.

..... [1]

(ii) How many more scientific papers used iPS cells rather than embryonic stem cells in 2016?

Number of scientific papers = ..... [1]

(iii) Suggest **two** reasons for the difference in use between the two types of stem cells seen in 2016.

- 1 .....
- 2 .....

[2]

**ADDITIONAL ANSWER SPACE**

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

A large area of lined paper for writing, consisting of 25 horizontal dotted lines. A solid vertical line runs down the left side of the page, creating a margin. The rest of the page is open for writing.

A large blank area with horizontal dotted lines for writing, spanning most of the page.



A large area of the page is reserved for writing, featuring a vertical solid line on the left side and horizontal dotted lines extending across the page.



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