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H

Tuesday 17 May 2022 – 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 | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

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 **20** pages.

ADVICE
- Read each question carefully before you start your answer.

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SECTION A

Answer **all** the questions.

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

Write your answer to each question in the box provided.

1 Which statement is true of **both** adult and embryonic stem cells?

A They are in all adult and embryonic tissues.

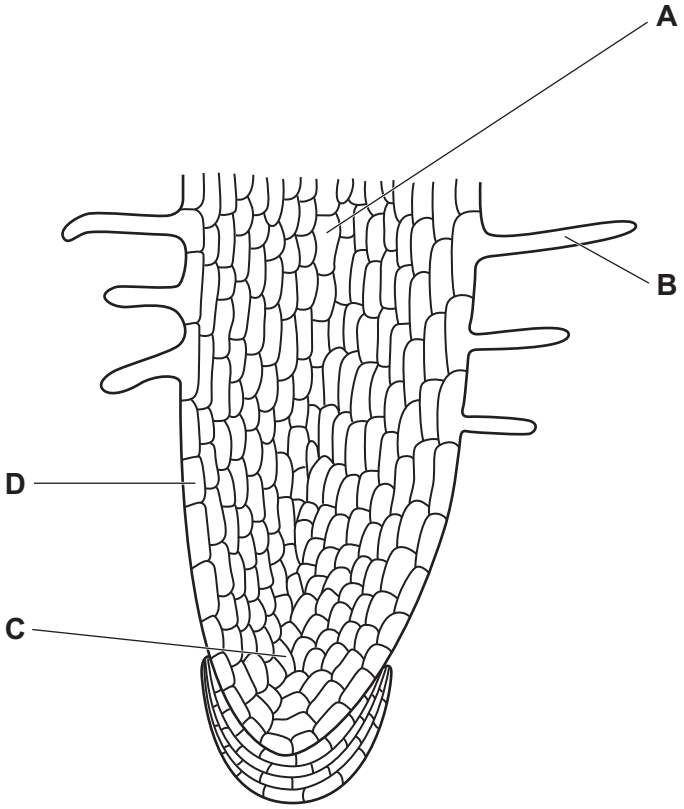
B They are only used to make blood cells.

C They can divide by mitosis.

D They cannot differentiate.

Your answer ☐ **[1]**

2 The diagram shows the root tip of a plant.



Which label, **A**, **B**, **C** or **D**, identifies the position of stem cells in the root tip?

Your answer ☐ **[1]**

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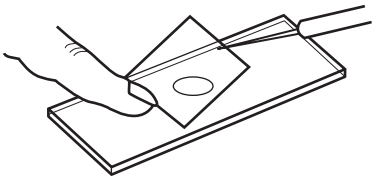
3 The diagram shows a student preparing some cells to view using a light microscope.



What are they lowering into place?

A Cover slip

B Lens

C Slide

D Stain

Your answer ☐ **[1]**

4 Which term describes a cell that contains plasmids but no mitochondria?

A Embryonic

B Meristem

C Prokaryotic

D Specialised

Your answer ☐ **[1]**

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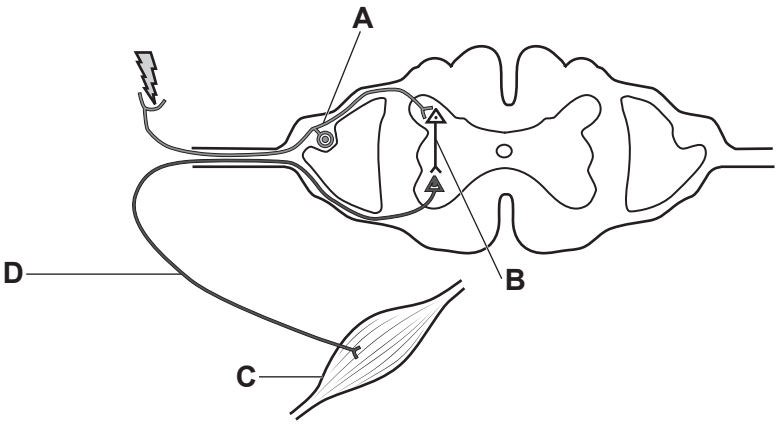
5 The diagram shows the structure of the reflex arc.



Which label, **A**, **B**, **C** or **D**, shows the motor neurone?

Your answer ☐ **[1]**

6 Which combination of hormones is often found in contraceptive pills?

A FSH and oestrogen

B FSH and progesterone

C Oestrogen and progesterone

D Oestrogen, progesterone and FSH

Your answer ☐ **[1]**

7 Which row shows the effects of adrenaline in the body?

	Breathing rate	**ATP production**	**Blood flow to digestive system**
A	increase	increase	increase
B	decrease	decrease	decrease
C	decrease	decrease	increase
D	increase	increase	decrease

Your answer ☐ **[1]**

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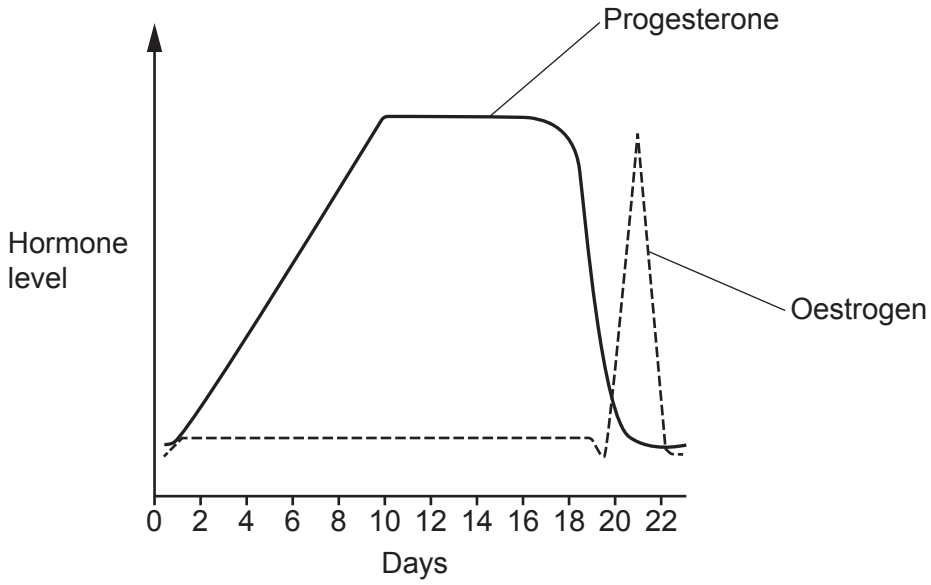
8 The hormones controlling the menstrual cycle in cows are the same as in humans.
The length of the menstrual cycle is different.

The diagram shows the menstrual cycle of a cow.



Predictions for when the cow is most fertile are made based on knowledge of the human menstrual cycle.

Which range of days is when the cow is most fertile?

A Days 1–3

B Days 3–6

C Days 9–16

D Days 19–22

Your answer ☐ **[1]**

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9 The table shows some information about four organisms.

	Surface area (m^2)	**Volume (m^3)**
A	6×10^{-12}	1×10^{-18}
B	6×10^{-8}	1×10^{-12}
C	6×10^{0}	1×10^{0}
D	6×10^{4}	1×10^{6}

Which organism has the smallest surface area compared to their volume?

Your answer ☐ **[1]**

10 Photosynthesis is affected by light intensity. The relative light intensity can be calculated using the inverse square law.

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

What is the distance from the light source when the relative light intensity is 0.04?

A 0.04

B 0.2

C 5

D 25

Your answer ☐ **[1]**

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SECTION B

Answer **all** the questions.

11 Plants and animals both have transport systems.

(a) **Fig. 11.1** shows cells found in the transport system of animals.

Fig. 11.1

(i) Identify the type of cell shown in **Fig. 11.1**.

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

(ii) The transport system in animals is the circulatory system.

Describe the relationship between the circulatory system and the gas exchange system in the human body.

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

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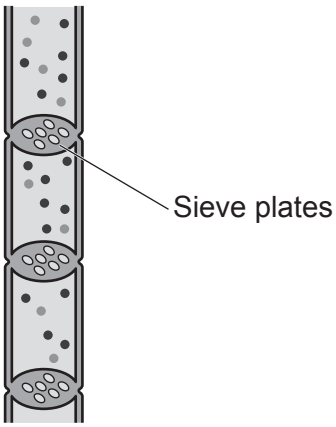
(b) Phloem is part of the transport system in plants. **Fig. 11.2** is a diagram of phloem sieve tubes.

Fig. 11.2



Explain how phloem sieve tubes are adapted to their function. Use **Fig. 11.2**.

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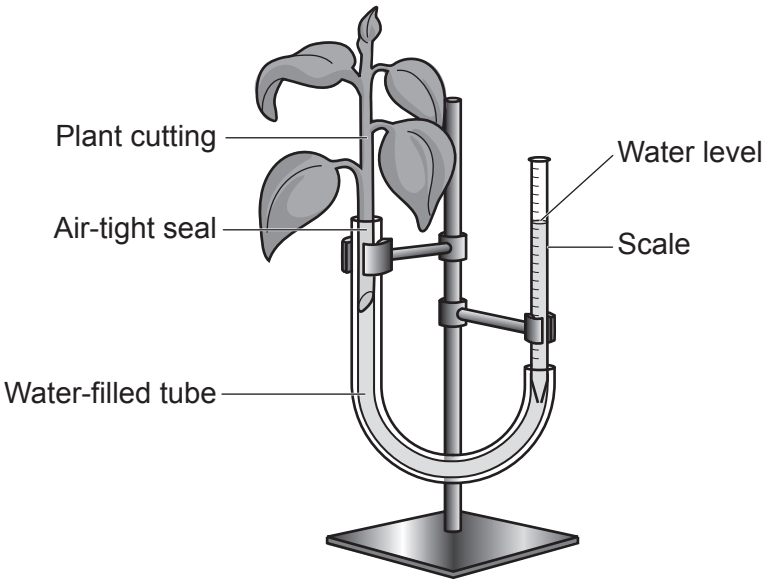
..... **[2]**

(c) **Fig. 11.3** shows apparatus used to investigate the rate of water uptake in plants.

Fig. 11.3



(i) Name the apparatus shown in **Fig. 11.3**.

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

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(ii) The air-tight seal stops air getting into the water-filled tube.

Suggest why it is important to stop air getting into the tube.

.....

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

(iii) The apparatus is set up and left for 10 minutes. The water level moved 8 mm.

Calculate the rate of water uptake in **mm per second**.

Give your answer to **2** significant figures.

Rate of water uptake = ... **mm per second [3]**

(iv) The investigation is repeated with an electric fan switched on next to the apparatus.

Predict what would happen to the rate of water uptake by putting a ring around the correct choice to complete the sentence. Explain your answer.

The rate of water uptake would **increase / decrease / stay the same**.

Reason: .....

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

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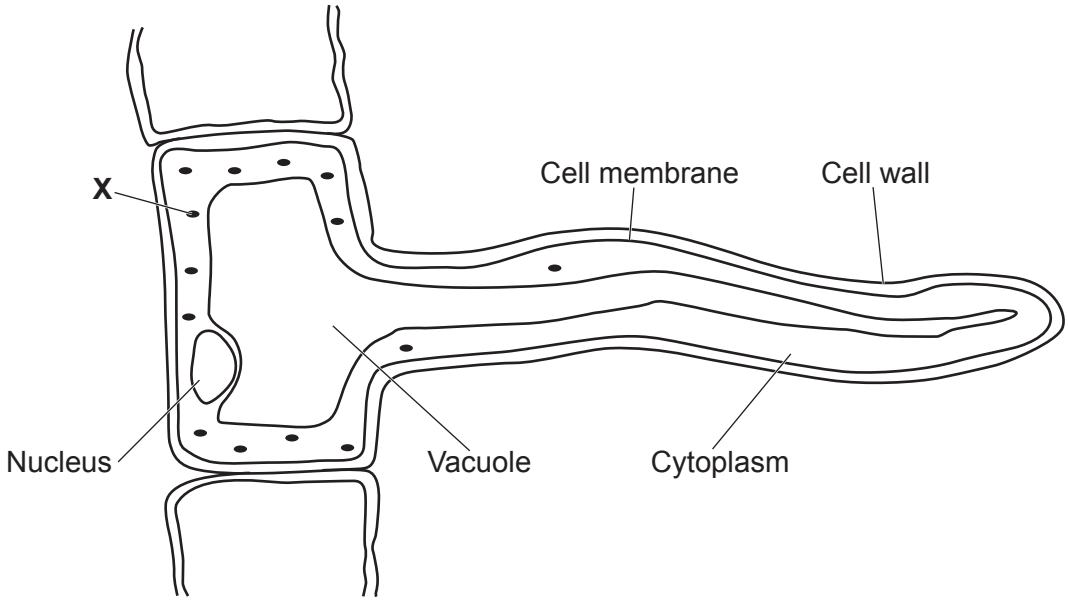
12 **(a)** The diagram shows the structure of a root hair cell.



(i) The structure labelled **X** contains enzymes needed for cellular respiration.

Identify the name of structure **X**.

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

(ii) The mineral concentration of soil surrounding the cell is lower than the mineral concentration inside the cell.

Explain how minerals are transported into the cell from the soil.

.....

.....

..... **[2]**

(b) Plants make a range of different molecules. One of these is glycerol.

Explain why glycerol is important.

.....

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

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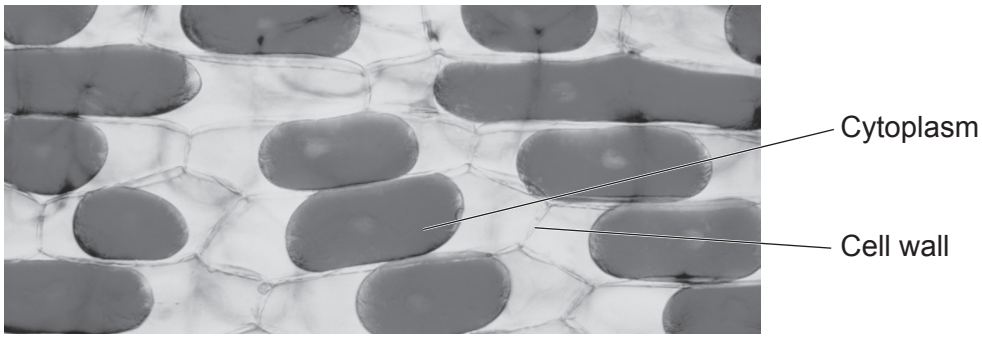
(c) A student investigates osmosis using onion cells. When water leaves an onion cell, the cytoplasm shrinks away from the cell wall. The cell is said to be plasmolysed.

The image shows plasmolysed onion cells.



This is the method the student follows:

- Place onion cells into different concentrations of salt solution.
- Observe the onion cells using a microscope after 30 minutes.
- Count the number of cells that can be seen and record how many were plasmolysed.

The table shows their results.

Concentration of salt solution (mol / dm^3)	Number of cells counted	Number of cells plasmolysed	Percentage number of cells plasmolysed
0.0	25	0	0
0.2	25	1	4
0.4	25	2	8
0.6	25	.....	48
0.8	25	19	76
1.0	25	24	96

(i) Calculate the number of plasmolysed cells the student counted in the 0.6 mol / dm^3 salt solution. Write your answer in the table. **[2]**

(ii) Use ideas about osmosis to explain the result for **1.0** mol / dm^3 salt solution.

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..... **[2]**

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13 **(a)** Plants photosynthesise to produce sugars.

(i) Describe the process of photosynthesis.

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

(ii) Explain the importance of sugars in the production of larger carbohydrates such as starch.

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

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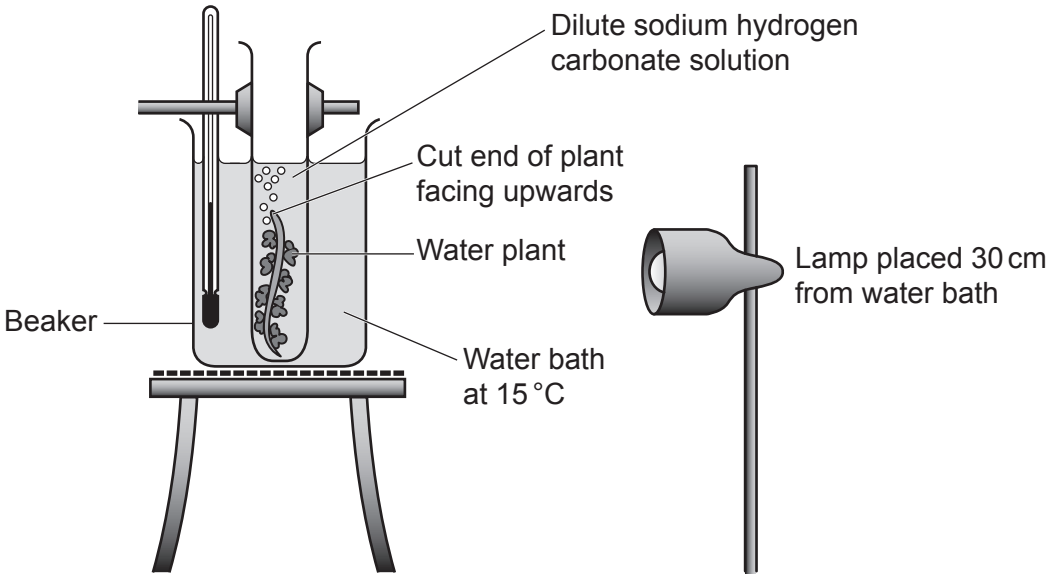
(b) A student investigates the effect of temperature on the rate of photosynthesis.

The diagram shows the apparatus they use.



This is the method the student follows:

- Count the number of bubbles released by the water plant in 10 minutes.
- Repeat this method with different temperatures of water.
- Count the bubbles three times at each temperature.

The table shows their results.

Temperature (°C)	Number of bubbles			
	Count 1	Count 2	Count 3	Mean
15	22	18	23	21
20	24	26	24	25
25	36	32	35	34
30	26	24	25	25
35	22	19	6	16(21)
40	2	4	1	2

(i) Look at the mean the student has calculated for 35 °C.

Explain why there is a second mean in brackets.

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..... **[2]**

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***(ii)** Photosynthesis is an enzyme-controlled process.

Explain the student's results.

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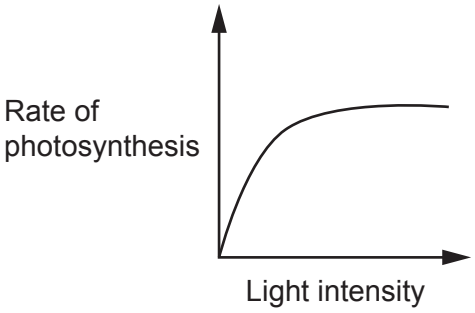
..... **[6]**

(c) The graph shows the effect of light intensity on the rate of photosynthesis.



Explain why the graph levels off.

.....

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

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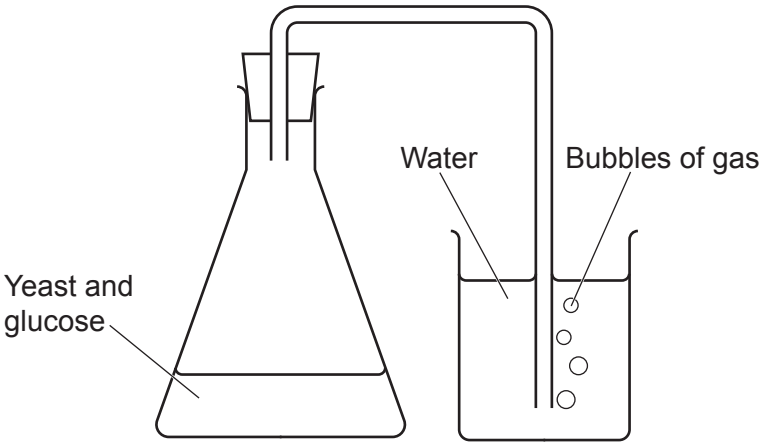
14 **(a)** A scientist investigates anaerobic respiration in yeast.

The diagram shows the apparatus they use.



This is the method the scientist follows:

- Count the number of bubbles produced in 10 minutes.
- Repeat the same investigation using different types of sugars.
- Use the same mass of yeast and the same volume and concentration of sugar each time the investigation is repeated.

(i) The scientist wants to obtain more accurate results for the rate of **anaerobic** respiration in yeast.

Describe **two** ways the scientist could improve their investigation to obtain more precise and accurate results.

1 .....

.....

2 .....

..... **[2]**

(ii) Describe how the scientist could use the apparatus in the diagram to find the effect of glucose concentration on the rate of anaerobic respiration.

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..... **[2]**

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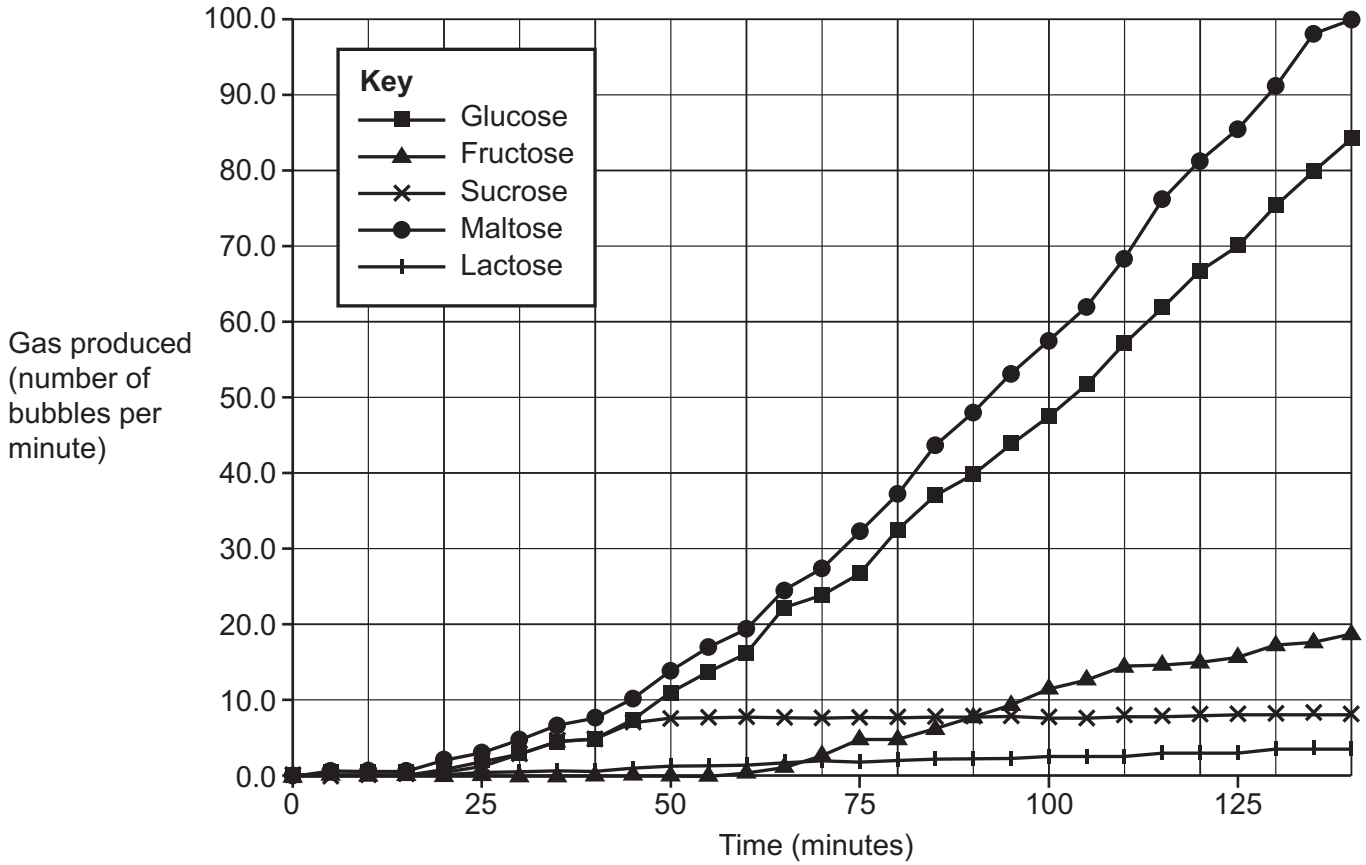
(b) The graph shows the number of gas bubbles produced by yeast using different sugars.



(i) Which sugar results in the fastest rate of anaerobic respiration?

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

(ii) Yeast takes time to process fructose before anaerobic respiration can occur.

Explain how the graph shows evidence of this.

.....

.....

.....

..... **[2]**

(c) Compare the **products** of anaerobic respiration in yeast with anaerobic respiration in humans.

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..... **[2]**

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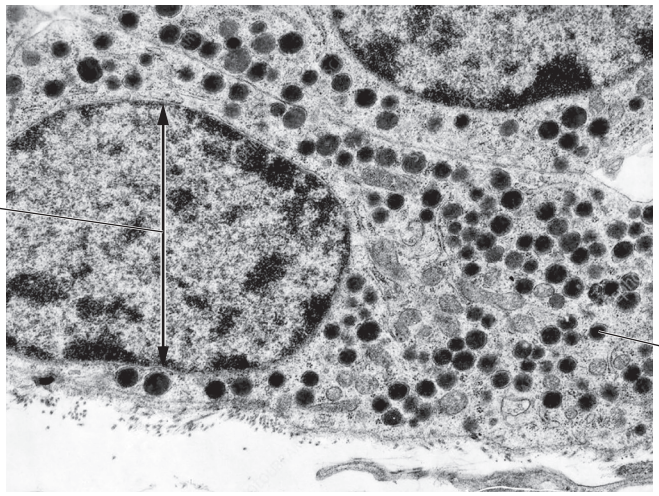
15 (a) **Fig. 15.1** shows parts of two cells found in the pancreas.

Fig. 15.1



(i) The image has been magnified 5800×.

Measure the length of **W** in **mm**. Use your answer to calculate the actual width of the nucleus.

Give your answer in **μm** to **2** significant figures.

Length of **W** = ... mm

Actual width of nucleus = ... μm
[3]

(ii) Glucagon granules inside the cells shown in **Fig. 15.1** store glucagon.

If the body has been exercising for some time, glucagon granules release their contents.

Explain why.

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

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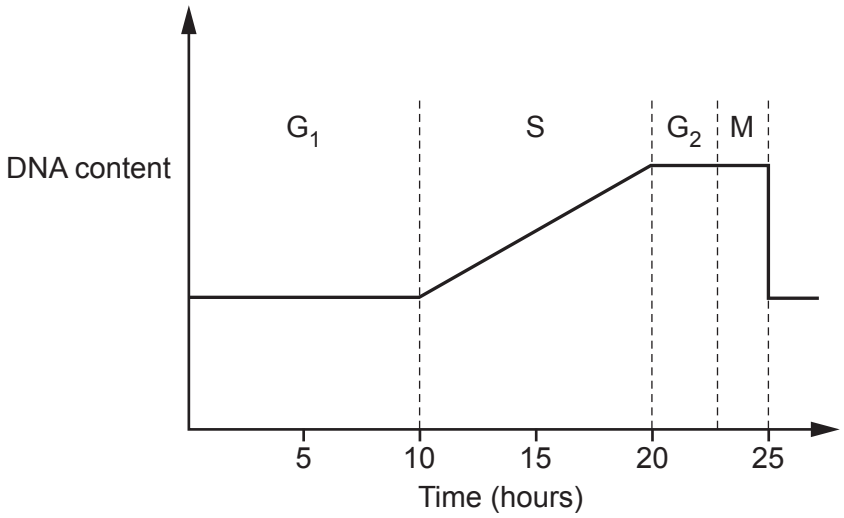
(b) **Fig. 15.2** shows the DNA content of the nucleus during different stages of the cell cycle.

Fig. 15.2



(i) How many hours does it take the cell to replicate the DNA?

..... hours **[1]**

(ii) Suggest what is happening to the cell during the first 10 hours of the cell cycle.

.....

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

END OF QUESTION PAPER

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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).

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