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Oxford Cambridge and RSA

GCSE (9-1)

Examiners' report

GATEWAY SCIENCE COMBINED SCIENCE A

J250

For first teaching in 2016

J250/07 Summer 2022 series

Version 1

ocr.org.uk/science

Contents

Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates.

The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. A selection of candidate answers are also provided. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report.

A full copy of the question paper and the mark scheme can be downloaded from OCR.

Advance Information for Summer 2022 assessments

To support student revision, advance information was published about the focus of exams for Summer 2022 assessments. Advance information was available for most GCSE, AS and A Level subjects, Core Maths, FSMQ, and Cambridge Nationals Information Technologies. You can find more information on our website.

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Paper 7 series overview

J250/07 is the first of two Higher Tier papers that determine the Biology content of the GCSE (9-1) Gateway Combined Science A course. It assesses content from specification topics B1-B3 and B7. This paper is not synoptic and so does not contain any material covered by topics B4-6. There are also questions that involve the assessment of key mathematical requirements from Appendix 5f of the specification.

There was clear evidence of knowledge and understanding (AO1) shown by candidates. Candidates did not perform as well when required to apply their knowledge to answer questions (AO2) or analyse information and ideas (AO3). There was some evidence that candidates had been entered for the incorrect tier, although this did seem to be less so than in 2019. However, there were still a number of candidates entered who could not access many of the marks, particularly in Section B. These candidates may have had a more rewarding exam experience if entered for the foundation tier. Candidates appeared to have had sufficient time to complete the paper, with the majority attempting most of the questions in section B.

OCR support

This tiering guide can be used to support your decision when entering students for particular tier. This guide for parents and students has frequently asked questions and their answers which may be useful to share when making your tiering decisions.

Candidates who did well on this paper generally did the following:	Candidates who did less well on this paper generally did the following:
• provided a full explanation of the date in Questions 12 (c) (ii) and 13 (b) (i) • were able to explain concepts and apply knowledge and understanding in Questions 11 (a) (ii) and 15 (a) (ii) • showed an understanding of practical procedures and how to develop investigations in Question 14 • complete calculations without error in Questions 11 (c) (iv) and 15 (a) (i).	• attempted to describe patterns in data in Question 13 (b) (i) but were unable to provide any explanation for the data • recalled some basic concepts of Biology in Question 13 (a) (i) but were unable to apply their knowledge • demonstrated a lack of understanding of how to develop investigation.

Section A overview

Section A consisted of multiple choice questions. It was encouraging to see that all candidates attempted these questions. Of these questions, candidates tended to do better on Questions 1, 3 and 4 and less well on Questions 2, 5 and 8. Where candidates decide to change their answer, they should be encouraged to cross out their original answer. They then should write the correct answer next to the box rather than try and write one letter on top of another.

OCR support

These multiple choice questions can be used to check knowledge and practice examination technique, such as changing an answer.

Question 1

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.

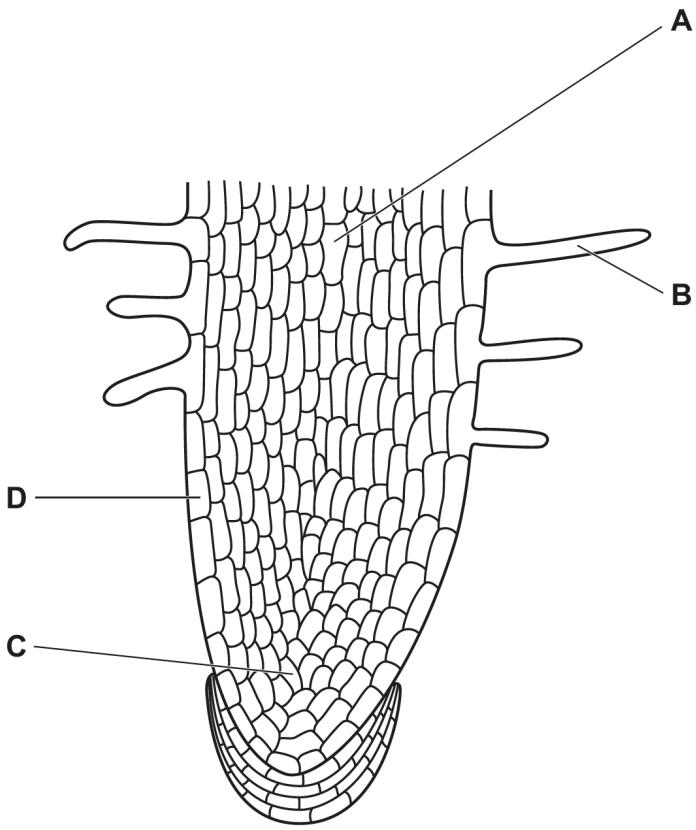
D They cannot differentiate.

Your answer ☐ **[1]**

Most of the candidates successfully identified C as the correct answer.

Question 2

2 The diagram shows the root tip of a plant.



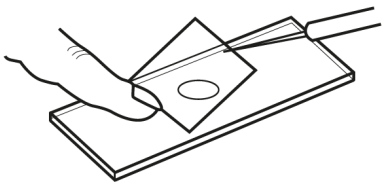
Which label, **A**, **B**, **C** or **D**, identifies the position of stem cells in the root tip?

Your answer ☐ **[1]**

Very few candidates were able to identify the position of the stem cells. Only the more successful responses managed to apply their knowledge of stem cells in plants and identify the position of the meristem.

Question 3

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]**

Most candidates understood that this was a cover slip.

Question 4

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

A Embryonic

B Meristem

C Prokaryotic

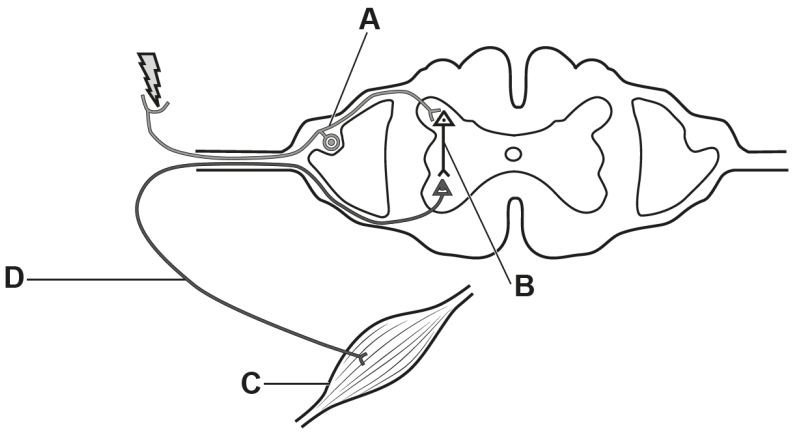
D Specialised

Your answer ☐ **[1]**

The majority of candidates identified prokaryotic as the correct answer.

Question 5

5 The diagram shows the structure of the reflex arc.



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

Your answer ☐ **[1]**

Candidates found it difficult to interpret the diagram to identify the motor neurone. They needed to identify the muscle tissue and make the connection between that and the motor neurone. Many incorrectly recorded A as their answer.

Question 6

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]**

About half the candidates identified C as the correct answer. There was no clear pattern to the alternative responses.

Question 7

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

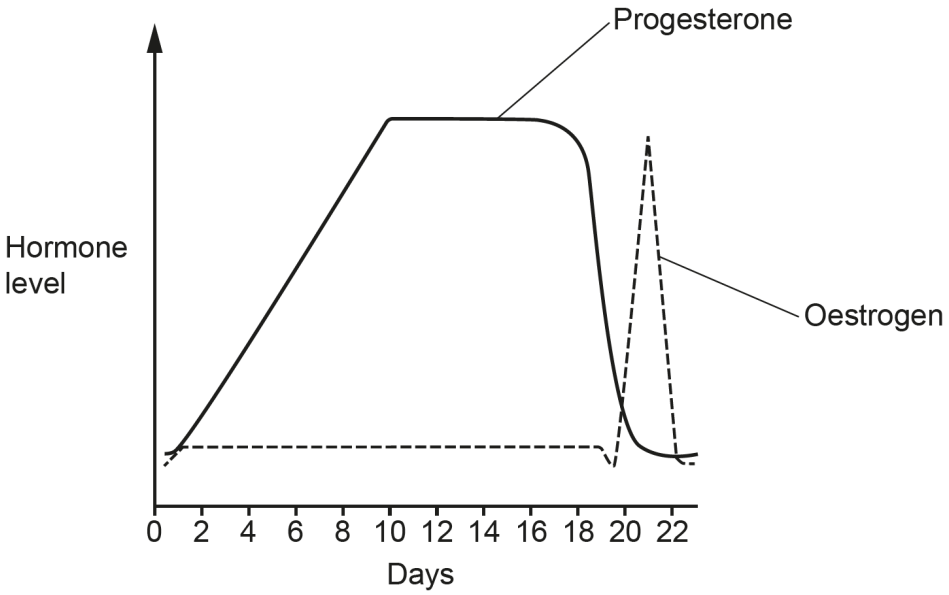
Your answer ☐ **[1]**

Candidates tended to either respond with the correct answer of D or the incorrect answer of A. This showed an understanding of adrenaline increasing process in the body. However, only the more successful candidates understood that blood flow is diverted away from the digestive system to the muscle.

Question 8

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]**

Very few candidates could apply their knowledge of hormonal control in the human menstrual cycle and interpret the diagram. The majority of candidates responded with the incorrect answer of C.

Question 9

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]**

Many candidates found the use of numbers in standard form confusing. There was evidence of calculations being used in an attempt to answer the question. To successfully answer the question, candidates needed to compare the powers of 10 to identify where the surface area value was smaller than the volume.

Question 10

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]**

Only the higher performing candidates were able to rearrange the calculation to obtain the correct answer of 5.

OCR support

The Mathematical Skills Handbook and accompanying check in worksheet would be useful to share with candidates or incorporate into lessons to practice using standard form and rearranging equations, among other mathematical skills.

Section B overview

Section B consisted of structured questions ranging from 1 to 6 marks. The majority of candidates attempted the level of response question. Throughout section B a large proportion of the candidates provided very long answers that tended to repeat what they had already said and, in some cases, contradicted their answers. They should be encouraged to use the number of lines within a question as a guide to the length of answer required. Often candidates provided vague answers where it was unclear as to the subject of the answer, see the comment for Question 13 (b) (i).

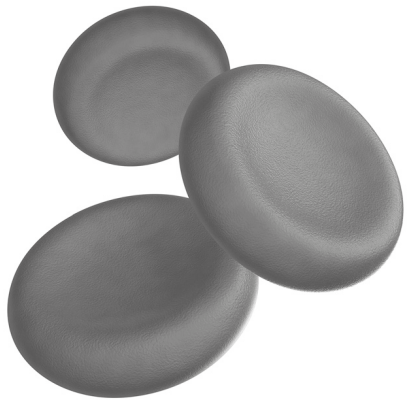
Many candidates made good use of the additional pages at the back of the paper especially when answering the level of response question. However, some candidates continued their answers below the answer lines provided or in some cases along the edges of the page.

Question 11 (a) (i)

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]**

The majority of candidates successfully identified the red blood cells. A few candidates did not include the term 'red' in their answer, therefore they could not be given the mark.

Question 11 (a) (ii)

(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]**

Although it was clear that many candidates knew the role of the circulatory system and gas exchange system, they found it challenging to describe the relationship. Many candidates used terms such as gas exchange without including the direction of movement of the gases involved.

Exemplar 1

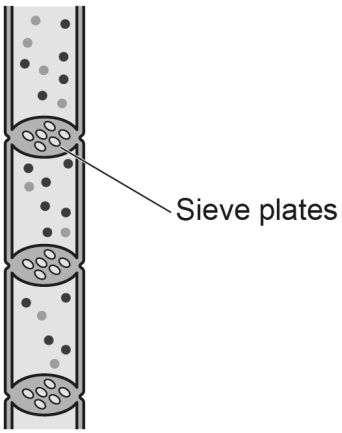
The circulatory system takes in oxygenated blood from lungs through pulmonary view into left atrium, past the valve, the oxygen diffuses into left ventricle and out the Aorta. The double circulatory system does two loops, one from heart to lungs and then heart to body. [3]
After it goes around the body it comes in from vena cava to right atrium, then ~~left~~ right ventricle the away from heart through pulmonary artery.
The gas exchange system in the alveolus also diffuses O2 into the deoxygenated blood, ~~through~~

The response from a candidate given all 3 marks shows a clear understanding of both systems and how they are linked. They have named the blood vessels that transport the blood to and from the heart and lungs. They have also described how and where oxygen diffuses into the blood. Like many candidates, they have provided irrelevant descriptions of a double circulation. The question required candidates to concentrate on the part of the circulatory system linked to the lungs and not simply describe the whole circulation. This extra irrelevant information resulted in the candidate using more space than was necessary.

Question 11 (b)

(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**.

.....

.....

.....

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

Candidates find explaining adaptations challenging when given unusual concepts. Many identified the sieve plates but were unable to explain how they were adapted. A common response included lengthy description of the sieve plates filtering unwanted substances. Where candidates referred to transport, they often used vague descriptions such as food rather than sucrose or sugar.

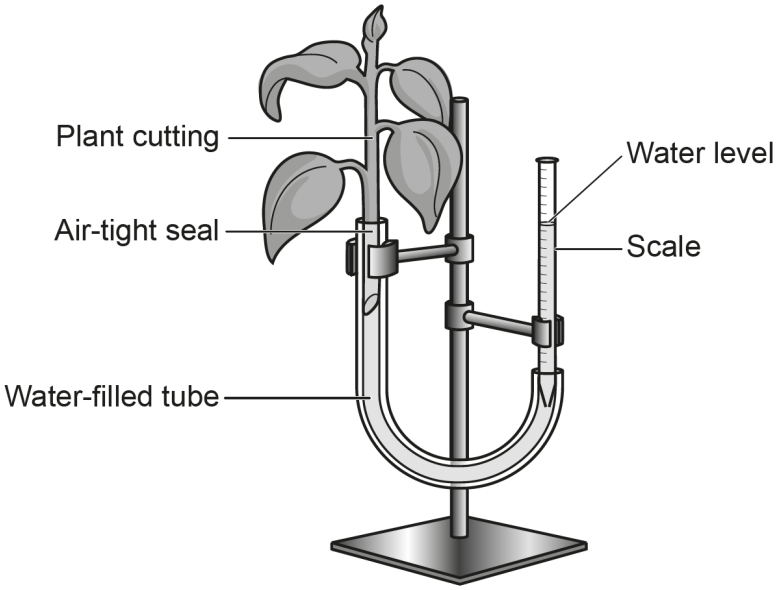
Misconception

Transport in phloem involves sucrose. Many candidates incorrectly assume the sugar transported is glucose. Others confuse the function of phloem and xylems incorrectly assuming mineral ions are transported by the phloem.

Question 11 (c) (i)

(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]**

Candidates should be made familiar with equipment that comes in all shapes and sizes. Few were able to identify the potometer.

Question 11 (c) (ii)

(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]**

Questions linked to practical procedures are challenging especially when candidates have not had the opportunity to use equipment. Centres are encouraged make candidates aware of all the practical procedures described in the specification learning outcomes. This question was testing B2.2j, where candidates are expected to know how to use a simple potometer. Where it is not possible for candidates to use equipment then centres are encouraged to find alternative arrangements.

OCR support

This Practical support guide has a variety of videos, activities and simulations that can be shared with candidates. These link to the Practical Activity Groups, and the apparatus and skills candidates must be aware of. Some of the practicals shown are in a different context than they may be carried out in the classroom, giving candidates further practice for examinations.

Question 11 (c) (iii)

(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]**

Candidates tended to gain at least one mark in this question. When completing calculations candidates should be encouraged to set out their working in a logical way rather than scattered around the space. It was encouraging to see that most candidates understood that they needed to convert minutes to seconds. Where many candidates lost the mark was not realising that $0.013\dot{3}$ with a dot above 3 is not 2 significant figures.

Question 11 (c) (iv)

(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**.

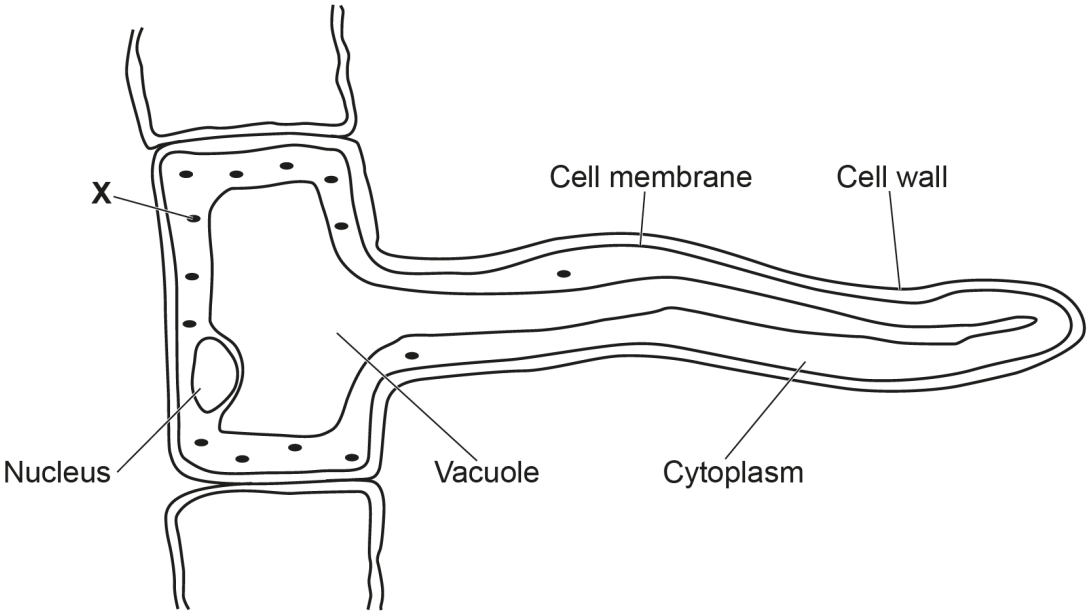
Reason: .....

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

The higher performing candidates showed an understanding of the effects of air movement on water uptake. Many candidates confused air movement with temperature and assumed the fan would cool down the plant reducing water uptake.

Question 12 (a) (i)

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]**

The majority of candidates correctly identified the mitochondria. A few lower performing candidates incorrectly assumed they were chloroplasts.

Question 12 (a) (ii)

(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.

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.....

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

With the exception of the less successful responses, candidates were able to recall the process of active transport. A few candidates simply repeated the stem in regard to the direction of movement rather than use the term concentration gradient or explain the need for an energy supply.

Question 12 (b)

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

Explain why glycerol is important.

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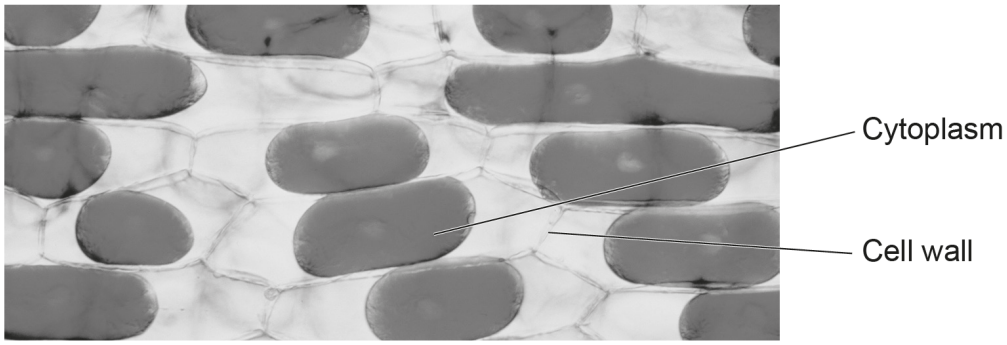
..... **[1]**

Candidates found this question challenging. Many confused glycerol with glycogen rather than its role in the formation of lipids.

Question 12 (c) (i)

(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]**

Candidates were able to successfully calculate the correct number of cells.

Question 12 (c) (ii)

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

.....

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.....

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

In this question candidates were required to explain why cells plasmolysed in 1.0mol/dm^3 solution. When answering questions about osmosis, candidates should be encouraged to use the idea water potential rather than concentration. When many candidates attempt an answer in terms of concentration, they often neglect to stress the movement of water molecules is from a high water concentration. Vague answers about movement from high concentrations to low concentrations could be referring to salt concentration.

Question 13 (a) (i)

13 (a) Plants photosynthesise to produce sugars.

(i) Describe the process of photosynthesis.

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.....

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

Candidates were able to successfully recall the process of photosynthesis. This question was a straightforward AO1 question. A few of the lower performing candidates confused photosynthesis and respiration, stating that the plants used oxygen rather than produced it. Candidates should be encouraged to describe the use of light energy rather than the Sun. There were a few candidates who thought heat energy was involved. A small number of candidates incorrectly stated that minerals were required for photosynthesis.

Question 13 (a) (ii)

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

.....

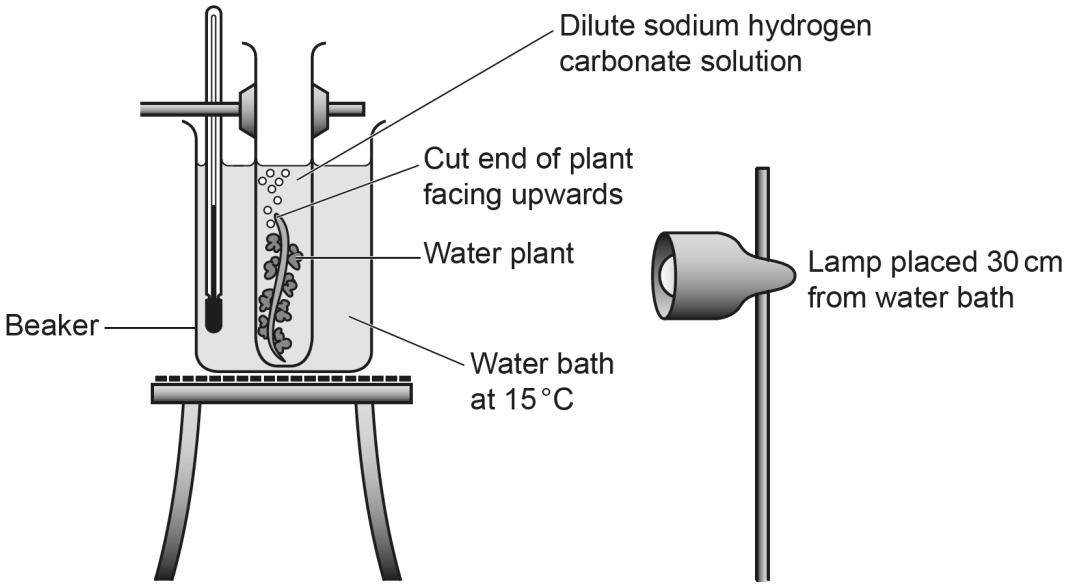
..... **[1]**

This question proved challenging for all but the higher performing candidates. The majority of candidates provided vague answers that were similar to the stem of the question. Very few made it clear that sugar molecules are joined together to make larger carbohydrates or used the terms monomer and polymer.

Question 13 (b) (i)

(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.

.....

.....

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

Identifying anomalies in data is an AO3 skill that candidates are able to do successfully. Most of the candidates realised there was an anomaly, however a few did not state which value it was. Explaining that the second mean did not include the anomaly proved to be more challenging. Many assumed the student had repeated the investigation or predicted the mean. In some cases, it was unclear which mean the candidate was referring to. The question asks about the mean in the brackets. Where candidates referred to the mean out of the brackets, they could be given credit if they clearly identified the mean. For example, '6 is an anomaly and was counted in the mean of 16', gains both marks. However, '6 is anomaly and only counted in one mean' does not make it clear which mean they are referring to so would only gain one mark.

Question 13 (b) (ii)

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

Explain the student's results.

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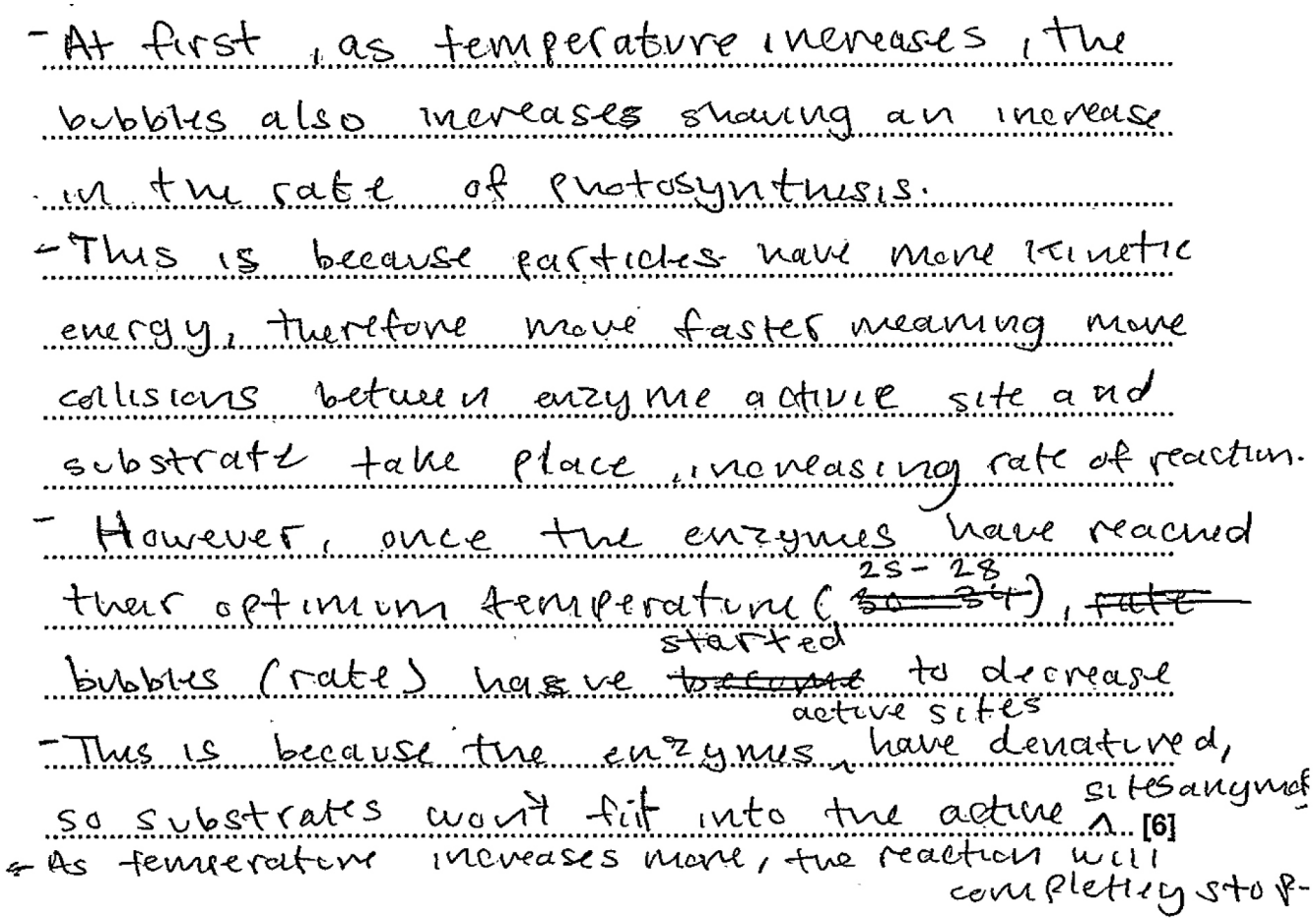
..... **[6]**

The majority of candidates were able to access the level of response question. Candidates are very good at recalling that enzymes denature at higher temperatures. However, only the higher performing candidates gave a full account of what denature means and the effect of temperature over the whole range of temperatures. Lower performing candidates usually gained marks by simply describing the results and identifying the optimum temperature. One common error was for candidates to assume the optimum temperature was similar to human enzymes rather than use the data provided.

When provided with data candidates should be discouraged from simply quoting numbers. For example, 'at 25°C the mean was 34' would gain no credit. The candidate would need to observe that at 25°C the number of bubbles was the highest. Candidates should also be encouraged to describe what happens to the number of bubbles over the complete range of temperatures.

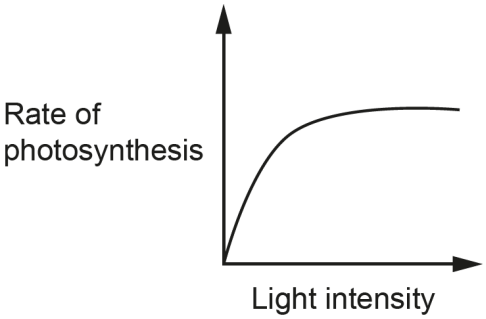
Exemplar 2



This exemplar is a response that gained all 6 marks. There is clear understanding of the effect of temperature across the whole temperature range. Only the higher performing candidates referred to kinetic energy of collisions in their response. They have identified the possible range for an optimum temperature based on the data provided. There is also evidence that they understand the concept of the lock and key hypothesis. The candidate has not just stated the word denature but explained what this means in terms of active site and substrate.

Question 13 (c)

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



Explain why the graph levels off.

.....

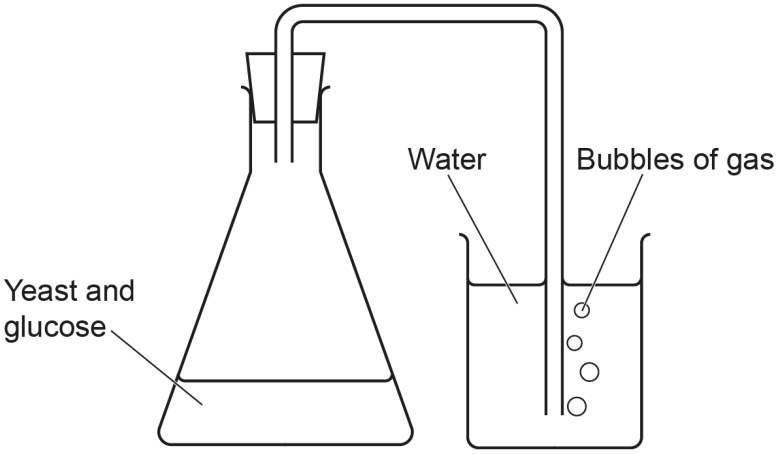
..... **[1]**

Only the higher performing candidates were able to switch from temperature to light intensity and limiting factors. Many of the lower performing candidates incorrectly assumed that enzymes had denatured again.

Question 14 (a) (i)

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]**

All of the candidates made a good attempt at this question. Although many assumed that finding other ways of counting the bubbles would make the results more accurate and precise. There were however an encouraging number of candidates that suggested methods of recording volume rather than number. A few candidates correctly referred to maintaining temperature, however the question required a description of how to do this.

OCR support

Our Language of Measurement in context resource can be used with candidates to help familiarise them with terms such as accurate and precise, and where to identify them in a practical.

Question 14 (a) (ii)

(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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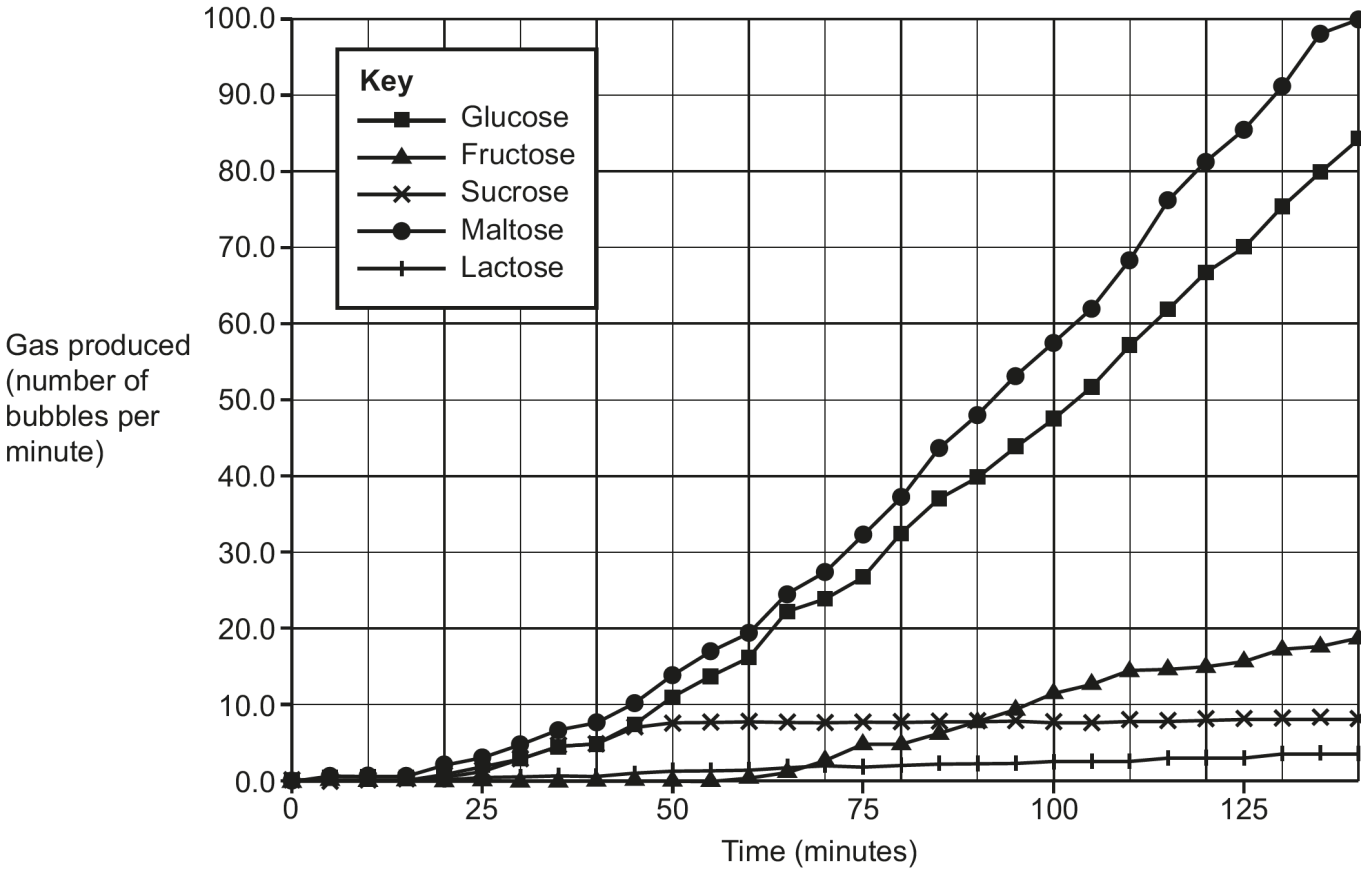
.....

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

Most of the candidates were successful describing how to repeat the process changing the concentration of glucose. Candidates should be encouraged to refer to concentration rather than volume or amounts of glucose. Vague comments about keeping everything the same should be discouraged. Only the more successful candidates identified a variable to control such as mass of yeast.

Question 14 (b) (i)

(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]**

The majority of candidates identified maltose.

Question 14 (b) (ii)

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

Explain how the graph shows evidence of this.

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

Most candidates were able to state evidence from the graph. Explaining the evidence proved more challenging. Many simply repeated the stem by explaining it took time to process the fructose rather than time to break it down. Only the very high performing candidates understood that glucose is usually used in respiration and that fructose might need to be converted to glucose before it could be used.

Question 14 (c)

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

.....

.....

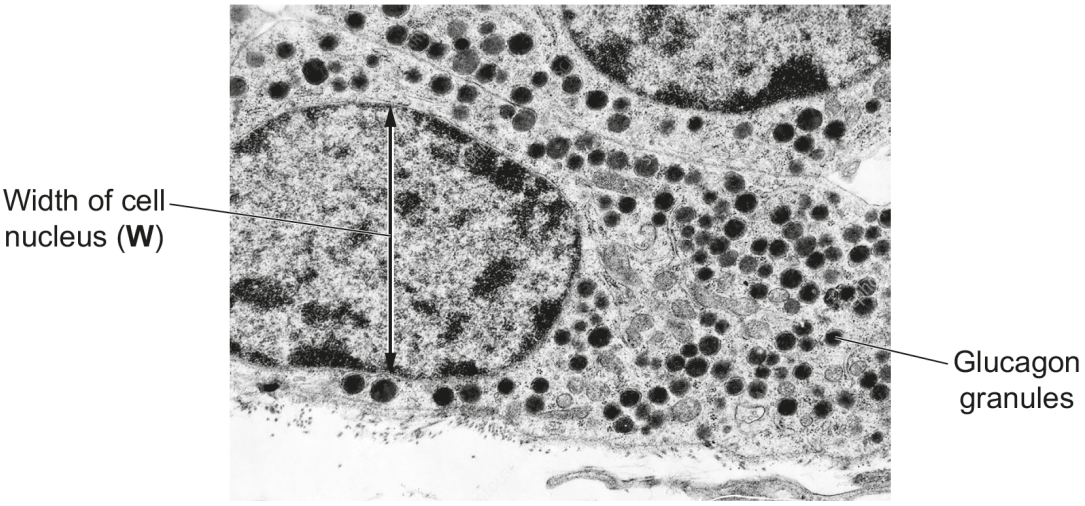
..... **[2]**

Candidates showed some understanding of anaerobic respiration. Usually, they identified lactic acid in humans. Many stated that yeast produced a gas but few could identify the gas as carbon dioxide. Recalling ethanol seemed to be a challenge for most candidates.

Question 15 (a) (i)

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]

Candidates were able to measure the length of W but a large proportion of the candidates gave their answer in cm rather than mm. Candidates should be encouraged to convert units and practice magnification questions as they appear on a regular basis. Converting the mm to µm also seemed challenging as many candidates neglected to divide their answer by 1000. Most of the candidates had shown their working. This is important as it enabled the awarding of marks for skills such as rounding values to 2 significant figures.

Question 15 (a) (ii)

(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.

.....

.....

.....

.....

.....

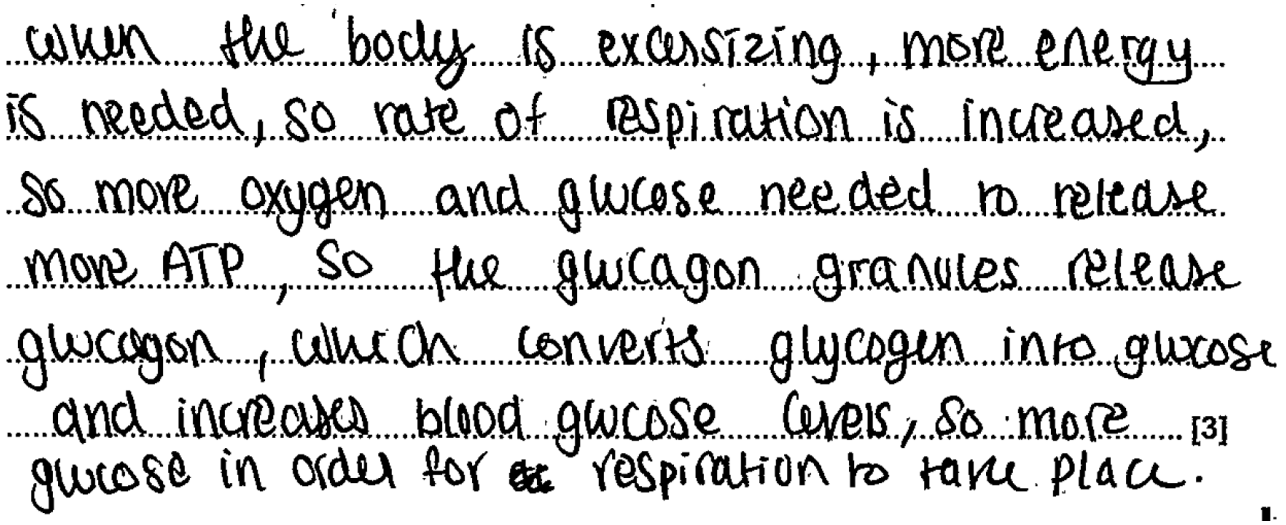
..... **[3]**

Only the higher performing candidates are able to apply challenging concepts such as the action of glucagon. Those candidates that identified the content of the granules as glucagon usually provided an answer given at least 2 marks. Many candidates incorrectly assumed the granules released glucose or energy.

Misconception

Terms such as glucagon, glycogen and glucose are easily confused. When using these terms correct spellings are vital. One common misconception is that glucose is broken down into glycogen. Or that glucagon is turned into glucose.

Exemplar 3

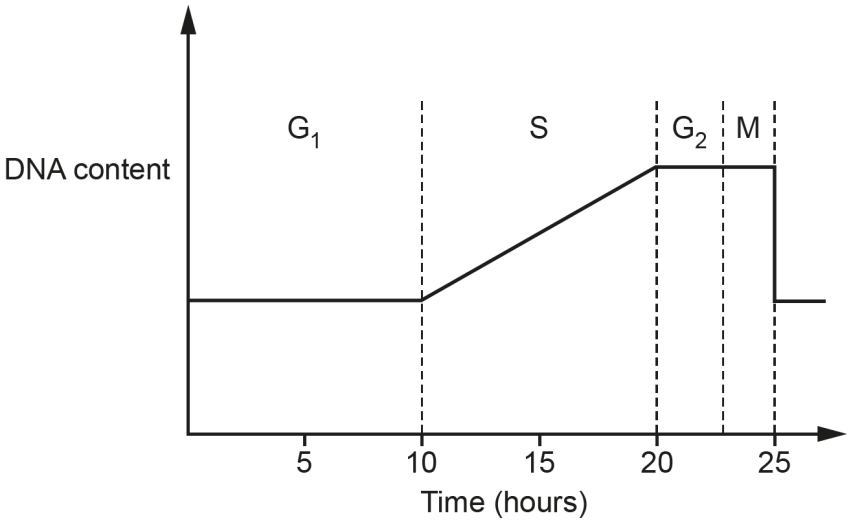


This exemplar is from a more successful response given all 3 marks. They demonstrate a clear understanding that exercise increases the rate of respiration; therefore, the body requires more glucose. This comparison is vital as many candidates neglected to apply their knowledge and simply stated the body needed glucose, or the body was respiring. Both of these would be happening at all times not just during exercise.

Question 15 (b) (i)

(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]**

A minority of candidates identified the correct answer of 10 hours. The majority assumed the answer to be 20 hours, not realising that DNA replication started after the first 10 hours.

Question 15 (b) (ii)

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

.....

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

Very few candidates mentioned cell growth or replication of organelles in their answer. They assumed the DNA was being replicated, even though there were no increases in DNA content.

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