

## **GCSE (9-1)**

*Examiners' report*

# **GATEWAY SCIENCE COMBINED SCIENCE A**

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**J250**

For first teaching in 2017

## **J250/07 Summer 2018 series**

Version 1

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## 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. 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 can be downloaded from OCR.

## 3-3 grade

Like all exam boards, we have awarded a 'safety net' grade of 3-3 for higher tier GCSE Combined Science candidates in 2018 where appropriate so that they are not disadvantaged by being the first to sit a new GCSE. To help teachers making difficult decisions about higher versus foundation tiers in 2019, OCR will be providing further guidance and extra webinars during the Autumn term.

## Paper J250/07 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.

## Section A overview – Questions 1 - 10

Section A consisted of multiple choice questions. It was encouraging to see that most candidates attempted all these questions. Of these questions, candidates tended to do better on questions 4, 5 and 6 and less well on questions 3, 7, 8 and 10. Question 10 proved the most difficult, as candidates tended to calculate the RDA as a percentage of the intake rather than the dietary intake as a percentage of the RDA.

## Section B overview

Section B consisted of structured questions ranging from 1 to 6 marks. There was clear evidence of knowledge and understanding (AO1). Candidates did not perform as well when required to apply their knowledge to answer questions (AO2) or analyse information and ideas (AO3). Candidates appeared to have had sufficient time to complete the paper, with the majority attempting most of the questions in section B.

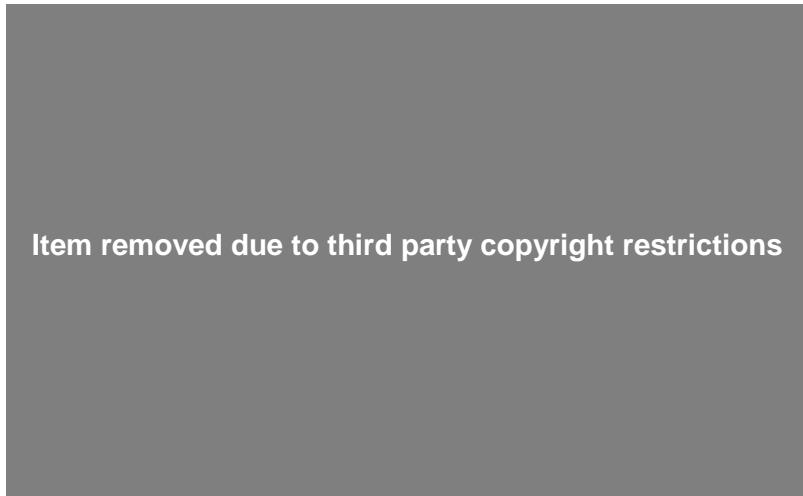
The majority of candidates attempted the level of response question. Throughout section B a large proportion of the candidates provided very long answers that tended to repeat what they had already said and in some cases contradicted their answers. They should be encouraged to use the number of lines within a question as a guide to the length of answer required.

Many candidates made good use of the additional pages at the back of the paper especially when answering the level of response question. Throughout section B many candidates did not make clear comparisons. When asked to make a comparison, candidates should be encouraged to use terms such as higher or lower rather than just high or low to give a more precise answer. There was also clear evidence that candidates had difficulty with the practical-based questions.

## Question 11(a)(i)

11 This question is about circulatory systems.

(a) The picture shows three different blood vessels **X**, **Y** and **Z**, seen using a light microscope.



(i) Compare blood vessels **X** and **Z** and describe the differences that can be **seen** in the picture.

.....  
.....  
.....  
.....  
.....

[2]

Although the majority of candidates gained at least one mark, a large number did not make two clear comparisons. Candidates should be encouraged to use terms such as 'thicker' walls not just thick walls. A few candidates assumed they were looking at blood cells rather than blood vessels and used terms such as 'thinner cell wall'. There were a number of candidates that misread the question and compared blood vessels **X** and **Y**.

## Question 11(a)(ii)

(ii) Blood vessel **Y** is a capillary. Explain how the structure of a capillary is adapted to its function.

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.....  
.....

[2]

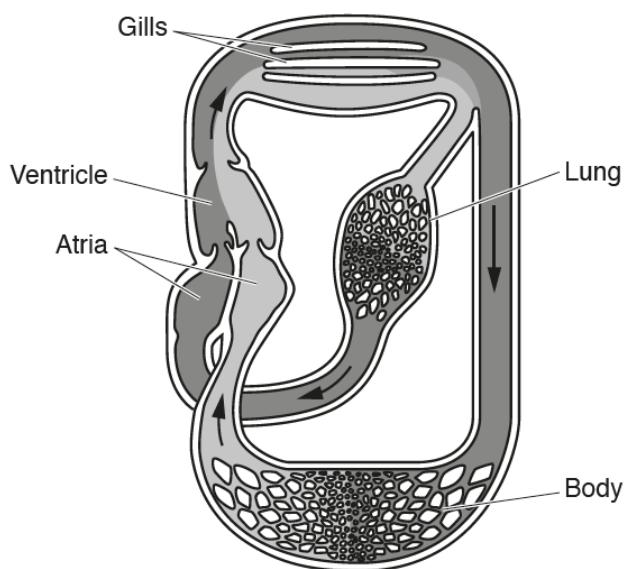
Very few candidates answered this question with the required detail. They talked about capillaries being thin but did not mention the walls of the capillary were thin to allow increased diffusion.

## Question 11(b)(i)

(b) Lungfish are fish that have both gills and a lung.

When in water, the blood flows through the gills. When on land, blood flow to the gills is stopped and the blood enters the lung instead.

The diagram shows the circulatory system of a lungfish.



The lungfish circulatory system is different to that of humans.

Blood in the lungfish can flow through gills and lungs, humans only have lungs.

(i) Write down one **other** way the **structure** of the lungfish circulatory system is different to that of humans.

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

Few candidates used the actual image to help them to identify the fact that the heart of the lungfish only has one ventricle. Most candidates answered in terms of double or single circulation. Candidates should use information given in question to answer this question.

## Question 11(b)(ii)

(ii) When lungfish and humans are on land, the human circulatory system is more efficient than that of lungfish.

Suggest why the human circulatory system is more efficient.

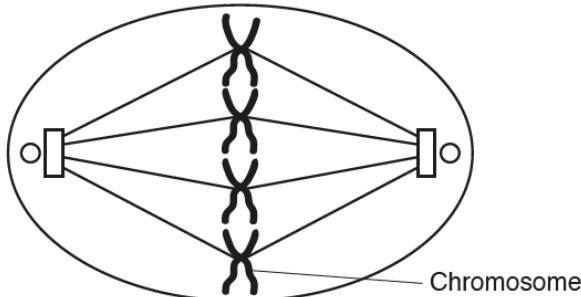
.....  
.....  
.....

[2]

Only high ability candidates were able to apply their knowledge of circulation to explain that humans have the advantage of separating oxygenated and deoxygenated blood and therefore their cells would have a greater supply of oxygen.

## Question 12(a)(i)

12 (a) The diagram shows a cell during one stage of mitosis.



(i) Describe **two** things that happen to the chromosomes in the next stage of mitosis.

.....  
.....  
.....  
.....

[2]

Most candidates were able to describe that the chromosomes were pulled apart to opposite ends of the cell. A few candidates mixed up mitosis and meiosis.

## Question 12(a)(ii)

(ii) Chromosomes are made of DNA.

Describe the structure of DNA.

.....  
.....  
.....  
.....

[2]

This question was successfully answered by the majority of candidates. Many going beyond the requirement of the specification, stating that DNA is a polymer and a double helix. Credit was given to those candidates who answered in terms of nucleotides and bases.

## Question 12(b)

(b) After mitosis, cell differentiation takes place.

What is meant by the term **cell differentiation**?

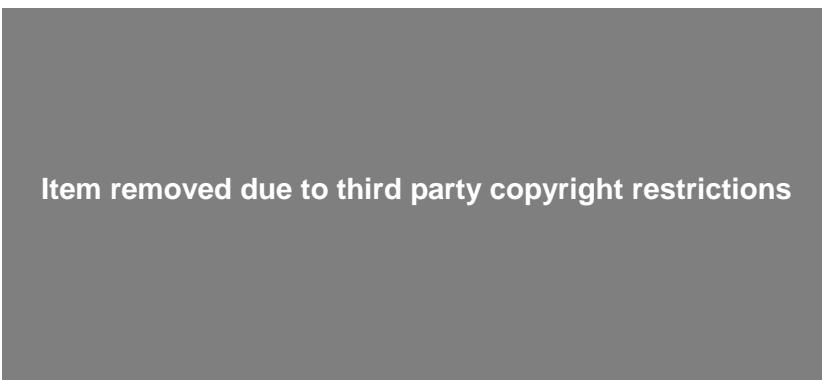
.....  
.....

[1]

Most candidates could answer this question in terms of cell becoming specialised. Some candidates gave vague answers about cells becoming adapted but did not make it clear that they would be adapted to carry out specialised functions.

### Question 13(a)

13 The picture shows plant cells as they are seen using a light microscope.



(a) The actual length of plant cell X is 75  $\mu\text{m}$ .

You can use this fact to calculate the magnification of the image.

Explain how.

.....  
.....  
.....  
.....

[2]

Candidates were able to recall the formula for calculating magnification. Only higher ability candidates could explain how to use the formula and ensure that both image and actual length had the same units.

## Exemplar 1

(a) The actual length of plant cell X is  $75\text{ }\mu\text{m}$ .  $\text{1 micro} \quad 1000\text{ }\mu\text{m} = 1\text{ mm}$

You can use this fact to calculate the magnification of the image.

Explain how.

I I  $75\text{ }\mu\text{m}$  is  $0.075\text{ mm}$  ✓  
 $A \times M$  first you would measure the image with a ruler  
to get a number and then divide it by  
the actual size - getting the magnification [2]

This response clearly shows the candidates understand how to convert micrometers to millimetres and calculate magnification. Although they have not said they would measure the image in millimetres, there is enough evidence to secure two marks.

(b) The same cells can be observed using an electron microscope.

Magnification of the cells can be increased using an electron microscope.

Explain how and why the image may also look different.

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

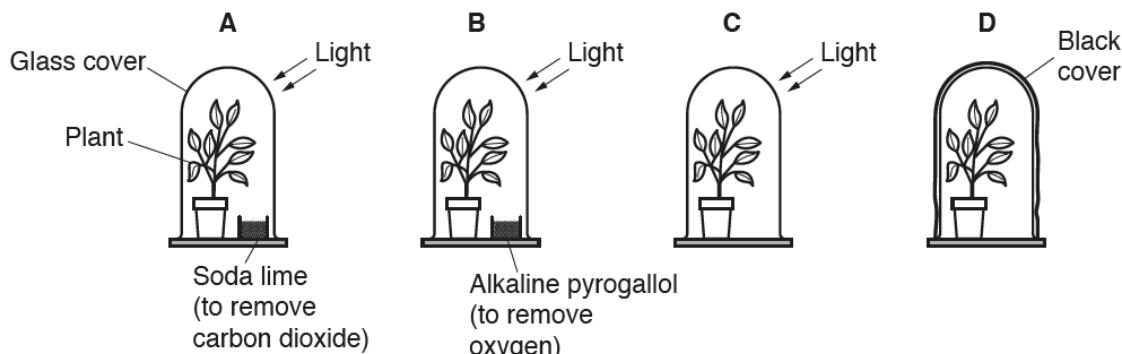
## Question 13(b)

This question discriminated well with the lower ability managing to at least recall that the image would not be in colour. Only higher ability candidates showed a clear understanding that the electron microscope has a higher resolution allowing smaller organelles to become visible. A common misconception was that chloroplasts only become visible using an electron microscope.

### Question 13(c)(i)

(c) A student investigates different conditions that affect photosynthesis.

He sets up four different sets of apparatus, **A**, **B**, **C** and **D**.



The plants used are all of a similar age and size. Each plant is left under cover at room temperature.

After three days one leaf from each plant is tested for the presence of starch.

(i) Describe all the stages required to test the leaves for the presence of starch.

.....  
.....  
.....  
.....  
.....

[3]

Candidates are expected to describe experiments used to investigate photosynthesis and this is a fundamental part of the process. Those candidates that were able to identify Iodine solution as the indicator, also tended to use the correct positive result of blue-black. A positive result of blue or purple is not acceptable as this causes confusion with other food tests. Very few candidates included ideas about heating with ethanol. Candidates had a lack of knowledge on the technique of how to test a leaf for starch and this is something that needs to be developed.

#### Exemplar 2

Blanch leaf in boiling water, soak the leaf in ~~alcohol~~ and blanch again. Place leaf on a tile and drop iodine onto it. If the orange iodine turns black starch is present.

[3]

no mark for the 'alcohol' as it is not boiling'black' is acceptable as positive test for starch

In this response the candidate has set out their answer in a clear and concise manner. They have identified the presence or absence of starch in each test and clearly stated their reason.

### Question 13(c)(ii)

(ii) What are the expected results of the starch test on each plant?

Write down reasons for your answers.

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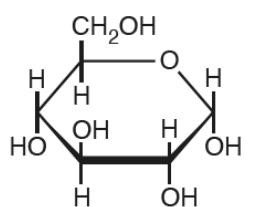
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[3]

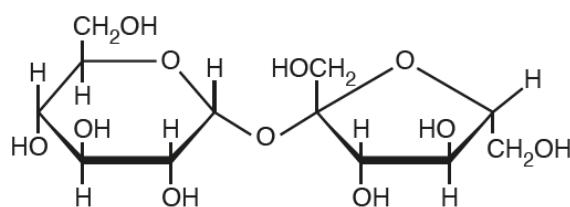
Only the higher ability candidates were able to give a clear answer worth all three marks. Identifying no starch in D as there was no light was the most common answer credited with one mark. Many candidates did not provide a valid reason why C had starch, the reason being it had all the conditions required for photosynthesis or that carbon dioxide and light had not been removed. A common misconception was to state that B had no starch because oxygen is needed for photosynthesis.

### Question 14(a)

14 The diagrams show the molecular structure of glucose and sucrose.



## Glucose



## Sucrose

(a) Compare the structures of these two carbohydrates.

[21]

[2]

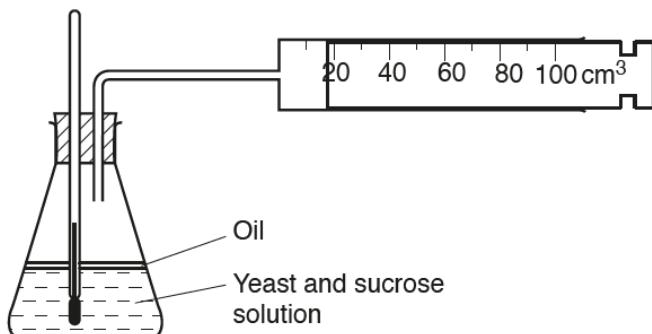
Candidates did not show a clear understanding of the term monomer and polymer, many incorrectly thought sucrose was a polymer. They also tended to suggest that the sucrose molecule was two separate molecules while glucose was one. Candidates gained marks because they used the information provided and identified differences in the number of elements present.

## Question 14(b)(i)

(b) Two students investigate **anaerobic** respiration using yeast with sucrose solution.

They measure the volume of gas collected every 5 minutes for 40 minutes.

The students then repeat the investigation using yeast with glucose solution.



(i) Explain how and why the temperature of the solution could change during the investigation and how this could be controlled.

.....  
.....  
.....  
.....

[2]

Very few candidates realised they could use a water bath to control the temperature. Only the higher ability candidates understood that the temperature would increase because anaerobic respiration is an exothermic reaction. Some candidates incorrectly assumed it was endothermic and suggested insulating the conical flask.

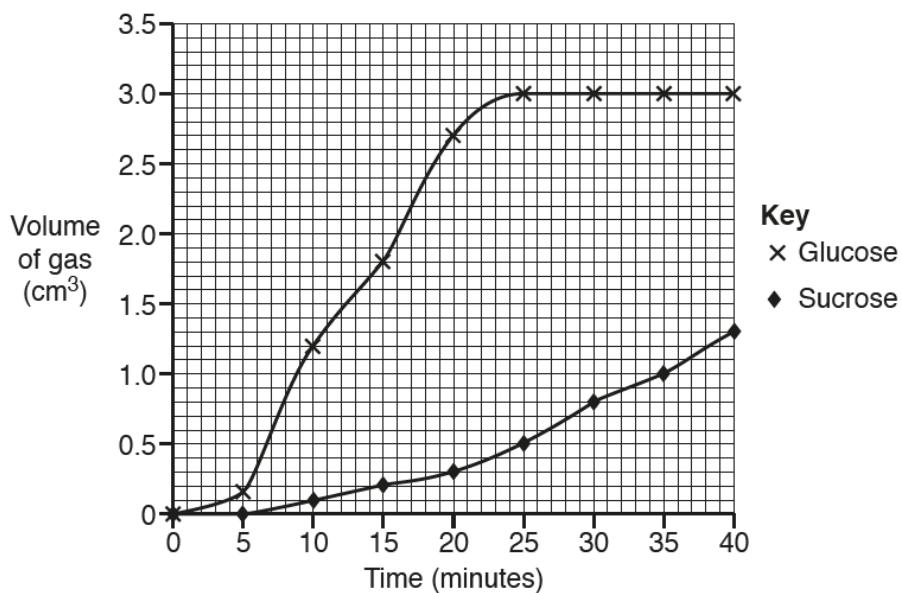
### Exemplar 3

Respiration is ~~an~~ exothermic reaction ✓ so the solution's temperature will increase. To control ~~of the~~ the temperature place the solution in a heated water bath at a certain temperature. ✓ [2]

The candidate in this response has used their knowledge of respiration to state that it is an exothermic reaction. They have applied their knowledge of practical activities to suggest that a water bath could be used to control the temperature.

## Question 14(b)(ii)

(ii)\* The graph shows the results of the investigation.



Explain the patterns seen in the results.

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

The majority of candidates successfully described the differences between the two lines in the graph. However only the most able candidates were able to explain the differences in terms of respiration. Those candidates that were credited with a level two answer tended to realise that the glucose line levelled off as the glucose has been used up. Very few stated that the increase in volume of gas is due to carbon dioxide being released. Only the very high ability candidates understood that sucrose is not the preferred substrate for anaerobic respiration and therefore during the first five minutes it needs to be converted to glucose. Some candidates responded in terms of temperature and enzymes denaturing, suggesting they had misunderstood what was happening in the investigation.

## Exemplar 4

Sucrose increases gradually because the ~~plants are~~ yeast is respiration anaerobically and producing carbon dioxide and ethanol.

Glucose is needed for the anaerobic reaction so the yeast ferments very quickly producing carbon dioxide and ethanol. The volume of gas increases then remains constant because all the glucose has been used up so the reaction could not increase any longer. Glucose releases a lot more gas than sucrose because sucrose needs to go through a reaction it self to form glucose of the yeast and respiration anaerobically. [6]

Glucose reached its maximum point to produce any more  $\text{CO}_2$  + ethanol.

This response shows a level three answer. The candidate not only describes the differences between the two lines but also makes an excellent attempt to explain them. They have identified the gas as carbon dioxide and explained that glucose will react faster as sucrose first needs to be converted to glucose before it can be used. They understand that glucose has been used up and hence the graph levelling off. The answer is not quite complete in that there is no reference to the first 5 minutes when no gas is being produced by sucrose. Also the answer jumps from sucrose to glucose and back again, hence a mark of 5 and not 6.

## Exemplar 5

The sucrose solution results show a positive correlation on at a steady rate. This compares to glucose, which also shows a positive correlation but up to 25 minutes. Glucose produced a much bigger volume of gas than sucrose, however the glucose solution then shows a constant rate after 3.0cm<sup>3</sup> of gas is produced, therefore resulting in the glucose solution unable to produce anymore gas.

[1]

This response shows the most common answer given by the majority of candidates. The candidate has clearly described the differences between the two lines on the graph, however they have offered no explanation. They state that glucose levels off and does not produce any more gas but they have not said why.

## Question 15(a)

15 A student investigates the effect of concentration on osmosis.

He cuts out five potato chips of similar mass. The student measures the mass of each potato chip.

He then places the potato chips in different concentrations of sugar solution.

After 30 minutes he removes the potato chips from the solution. He dries them with a paper towel before measuring the new mass.

(a) The potato chips are dried before the new mass is measured.

Explain why.

..... [1]

Many candidates tried to explain the answer in terms of osmosis when this question was examining their practical skills rather than their knowledge. Some candidates realised it would affect the results but did not clearly state that excess solution would increase the mass of the potato chip. Candidates should be encouraged to provide direction in their answers, it is common for them to say "it effects the results" without saying if it increases or decreases the results.

## Question 15(b)

(b) The table shows his results.

Concentration of sugar solution (mol/dm <sup>3</sup> )	Mass of potato chip (g)		Change in mass (g)	Percentage change in mass
	At start	After 30 minutes		
0.0	2.1	2.7	+0.6	+28.6
0.2	2.2	2.3	+0.1	+4.5
0.4	2.0	1.8	-0.2	-10.0
0.6	2.0	1.6	-0.4	-20.0
0.8	2.3	1.7		
1.0	2.2	1.6	-0.6	-27.3

Calculate the percentage change of mass for the potato chip in 0.8 mol/dm<sup>3</sup> sugar solution.

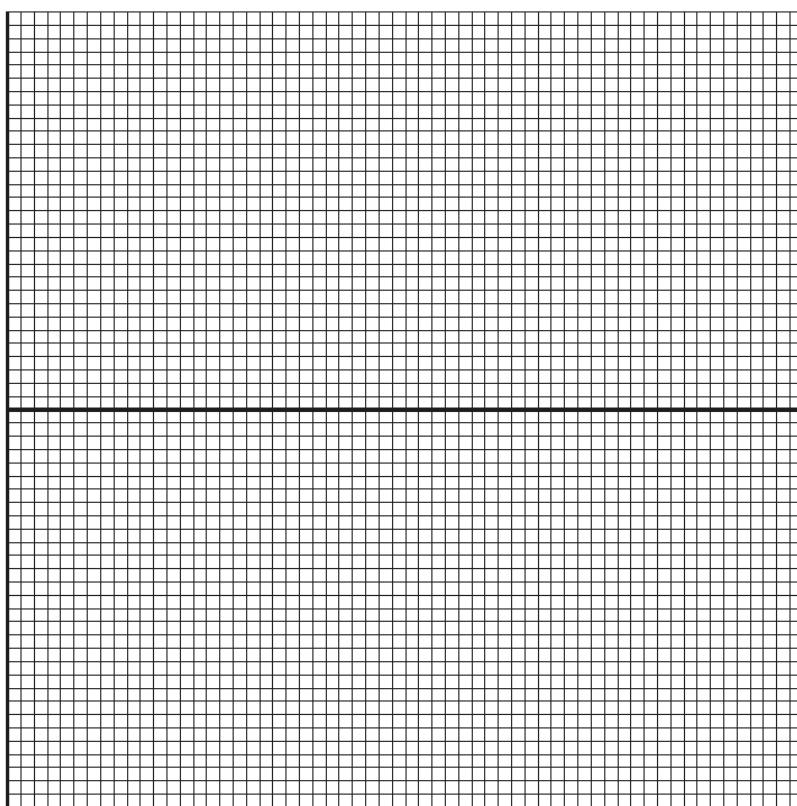
Record your answer to 1 decimal place.

Answer = ..... % [2]

Only the higher ability candidates had the mathematical skills required to calculate percentage change in mass. Some candidates provided the correct answer in the table but then did not put the negative sign before the number on the answer line.

### Question 15(c)

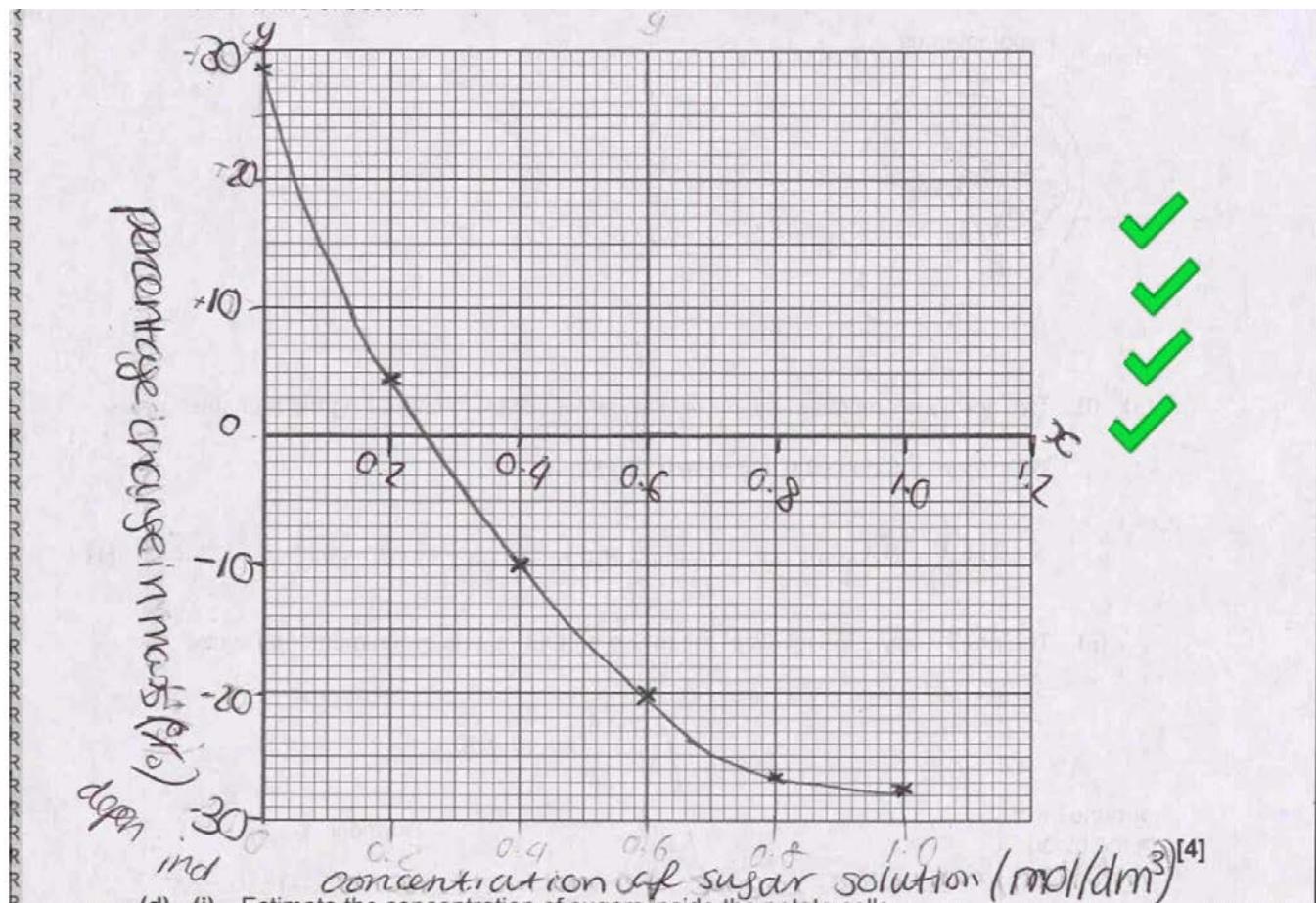
(c) Plot a graph of the percentage change in mass against concentration of sugar solution and draw a line of best fit.



[4]

Those candidates that did well overall on the paper were able to produce a suitable graph. Although some of these lost a mark for not including the units or using a straight line when the results clearly show a curve. Some candidates were unable to cope with negative numbers so just plotted all the points as positive numbers. There were a few candidates who chose to plot the wrong set of data and could only be credited with the line of best fit.

## Exemplar 6



In this response the candidate has clearly demonstrated mathematical skill Mc4 (Plot two variables from experimental or other data). They have plotted negative values and included units on the axis labels. The line of best fit has been clearly drawn through the points producing a curve. This shows a clear understanding of how to draw the graph associated with this practical and suggests valuable prior experience.

## Question 15(d)(i)

(d) (i) Estimate the concentration of sugars inside the potato cells.

Answer = ..... mol/dm<sup>3</sup> [1]

This question required candidates to apply their knowledge of osmosis and realise that the net movement of water would be zero when the concentration of sugar inside the potato matched that of the solution. Only the most able candidates were able to do this.

## Question 15(d)(ii)

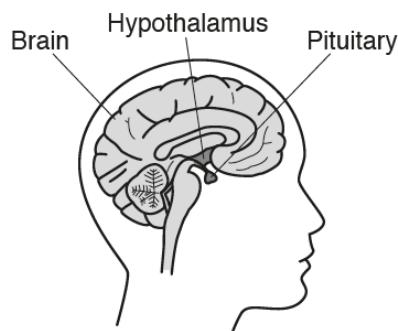
(ii) Use ideas about osmosis to explain the patterns in the results.

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

Candidates that answered this question in terms of water potentials found it easier to explain the patterns and gain marks. Those that answered in terms of concentrations tended to get confused as they did not clearly state if the higher concentration was that of water or sugar. Water potentials are new to this specification as past specifications defined osmosis in terms of water concentration. Candidates are not expected to explain what 'water potential' but if they use the term they will find answering this sort of question easier. Many candidates had the misconception that the solution or sugar was moving not the water molecules. They also tended to just state the definition of osmosis without applying it to the situation.

## Question 16(a)(i)

16 The diagram shows the position of the pituitary gland and hypothalamus in the body.



(a) (i) Two hormones released by the pituitary are involved in controlling the menstrual cycle.

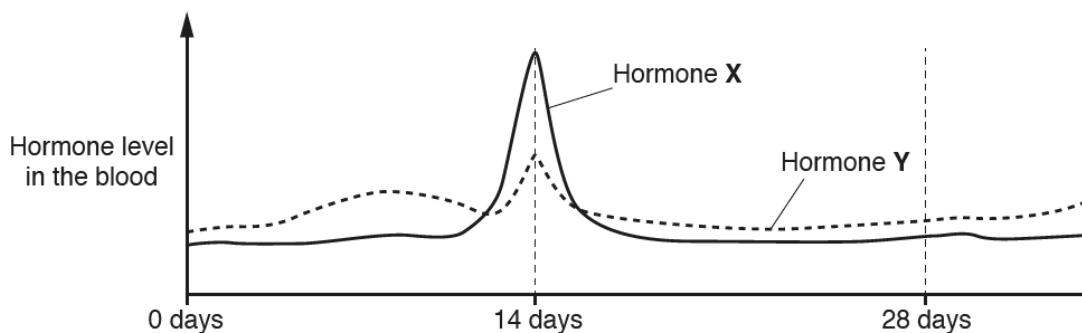
Write down the names of these **two** hormones.

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

Most candidates were able to identify the two hormones.

## Question 16(a)(ii)

(ii) The graph shows the levels of these two hormones during the menstrual cycle.



Use the graph to explain how these two hormones work together to cause ovulation.

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

Where candidates were credited with one mark it tended to be for the AO1 aspect of recalling that FSH causes the egg to mature. Fewer candidates were awarded marks for the AO2 aspect of using the graph to identify that hormone X peaks on day 14 to release the egg. Many candidates confused the role of these two hormones with that of progesterone and answered in terms of uterus lining.

## Question 16(b)

(b) The hypothalamus is involved in the regulation of body temperature.

Explain why this function of the hypothalamus is important to the role of enzymes.

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

Most candidates were able to explain that it is important the hypothalamus regulates the body temperature so that enzymes can work at their optimum temperature. Many also explained that high temperatures would cause the enzymes to denature. Only the higher ability candidates understood that low temperature slow down the enzyme activity and they do not denature them.

## Erratum notice

### Instructions to candidates:

Turn to question 6, on page 5 of the question paper.

At the end of the second sentence change '3.84' to '**3.84 : 1**'.

The second sentence of the question should now read:

The surface area to volume ratio of the elephant is **3.84 : 1**.

This did not appear to have any effect on the performance of candidates.

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Section A, Q2

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Section B, Q11b

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