Pearson Edexcel

Examiners' Report
June 2025

GCSE Combined Science 1SC0 2BH

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June 2025

Publications Code 1SC0_2BH_2506_ER

Introduction

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Introduction

The Pearson Edexcel GCSE (9-1) Paper 4 Combined Science (Higher tier) paper is part of the six papers required for the GCSE (9-1) Combined Science qualification worth two GCSE grades. The qualification follows a linear assessment model whereby candidates must complete all six papers in the same single year of certification.

Paper 4: Combined Science (Higher tier) is awarded a total of 60 marks, and it is assessed by a variety of question types, including, multiple-choice questions, short answer questions, calculations, and one extended open-response question. Students should answer all questions in a time of 1 hour and 10 minutes. The extended open-response question is identified by an asterisk (*) in the question paper to indicate that marks are also awarded for the ability to structure a response logically.

In addition, the GCSE (9-1) Combined Science qualification assesses practical knowledge and maths skills; the requirements of which are given in the specification. Furthermore, there are 6 mandatory core practical tasks from the biology section of the specification that students must complete prior to the examination, as aspects of working scientifically are also assessed in questions throughout the paper.

This paper contains questions assessing the content from topics 1 and topics 6 to 9 as identified in the specification. In this examination series, students were required to respond to questions that tested their knowledge and understanding of ciliated epithelial cells, aerobic respiration, osmosis, diffusion, gas exchange in plants and the movement of sucrose through a plant, the structure of the heart and blood cells and hormonal regulation of the menstrual cycle.

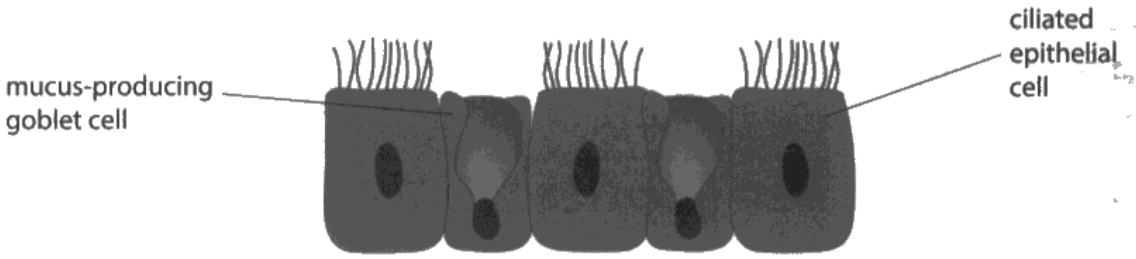
Questions designed to assess practical work included respiration in maggots, the use of microscopes and habitat sampling. The maths skills assessment in this paper related to questions on rate calculations, interpretation of data from tables and graphs, construction of a graph, percentage calculation and the application of significant figures.

There are now multiple past papers with mark schemes and examiner's reports on many websites available as well as practical support booklets for this qualification and it is clear that these resources are being utilised as part of the revision process. The use of scientific terminology in responses continues to improve. Improvements were seen in responses to questions on osmosis, plant transport and aerobic respiration. Most candidates were able to access the extended writing responses although there was some confusion over the role of glycogen, glucose, glucagon and insulin which resulted in the question scoring a range of levels by different ability candidates. The responses to practical questions on respiration in maggots was answered well and responses describing the use of a microscope showed improvements in comparison to previous years. Diffusion was well understood, and candidates showed some improvements in identifying controlled variables, however, there was a lack of understanding of the term reliability. In general, maths questions showed a good level of understanding with an improvement in the use of significant figures.

Question 1(a)

Candidates were asked to explain how ciliated epithelial cells removed pathogens from the airways. This is related to a diagram showing goblet cells and ciliated epithelial cells. The expected response included the idea that the pathogens would get stuck in the mucus and would be moved away from the lungs by the cilia. It was acceptable to state that they were moved so could be swallowed or go to the stomach or even the idea that they were wafted up to the back of the throat or coughed out. Candidates lost marks on this question by just repeating information from the questions as well as the misconception that pathogens get stuck in the cilia or hair-like structures rather than the mucus.

1 (a) Figure 1 shows a diagram of mucus-producing goblet cells and ciliated epithelial cells in the airways of the lungs.



(Source: © K.K.T Madhusanka/Shutterstock)

Figure 1

Describe how pathogens are removed from the airways by ciliated epithelial cells.

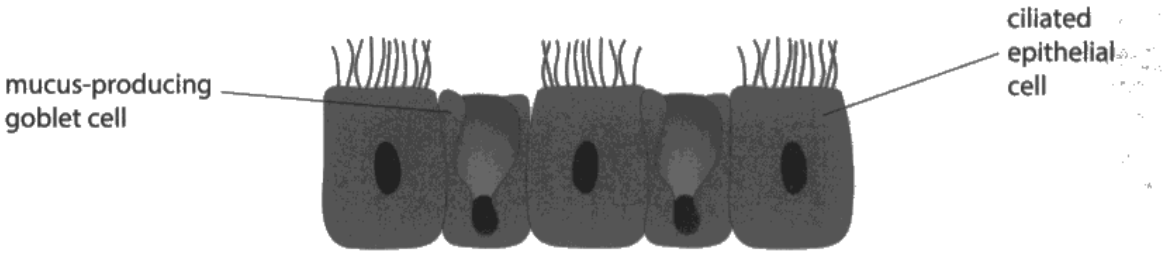
(2)

They are caught by the mucus produced and then the ciliated epithelial cell removes them by coughing the mucus up

ResultsPlus Examiner Comments

This answer states pathogens are caught in the mucus for one mark and coughing removes them for the second mark. Being removed by the ciliated epithelial cells just repeats the information given in the question.

1 (a) Figure 1 shows a diagram of mucus-producing goblet cells and ciliated epithelial cells in the airways of the lungs.



(Source: © K.K.T Madhusanka/Shutterstock)

Figure 1

Describe how pathogens are removed from the airways by ciliated epithelial cells.

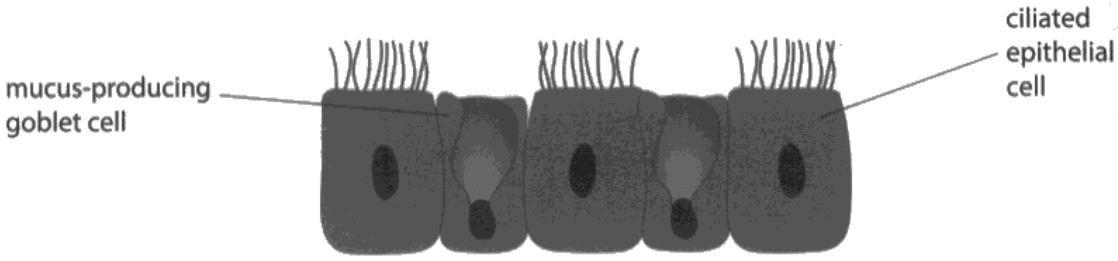
(2)

The ciliated epithelial cells remove pathogens as it can be used to waft the pathogens away after the pathogens have been identified.

ResultsPlus
Examiner Comments

This scored zero as it does not say how the ciliated epithelial cells remove the pathogens. There is no information beyond what is given in the question.

1 (a) Figure 1 shows a diagram of mucus-producing goblet cells and ciliated epithelial cells in the airways of the lungs.



(Source: © K.K.T Madhusanka/Shutterstock)

Figure 1

Describe how pathogens are removed from the airways by ciliated epithelial cells.

(2)

Pathogens are removed by the ciliated epithelial cell as by them moving the pathogen into the mucus.

ResultsPlus
Examiner Comments

This gained one mark for the pathogens being in the mucus.

Question 1(b)

For this question candidates were asked how the athlete gained energy from aerobic respiration. The accepted answer included the idea that glucose and oxygen reacted to form carbon dioxide and water. The equation for respiration could be credited both marks, if this was written as a symbol equation the symbols needed to be correctly written. Both reactants and products were required. The idea that this happens in the mitochondria and is an exothermic reaction was also credited. Marks were lost for just stating that oxygen was needed rather than glucose and oxygen or confusing reactants and products.

(b) During a race, athletes respire aerobically and anaerobically.

Figure 2 shows an athlete after a race.

(Source: © voronaman/Shutterstock)

Figure 2

Explain how aerobic respiration provides energy for running.

(2)

aerobic respiration is respiration with oxygen. respiration releases energy. ~~one~~ This energy causes blood to travel to the muscles, heart and brain faster. Also releases glucose.

ResultsPlus
Examiner Comments

This illustrates confusion between the reactants and products for respiration and scored zero.

ResultsPlus
Examiner Tip

Learn the key word equations for aerobic respiration, anaerobic respiration and photosynthesis.

(b) During a race, athletes respire aerobically and anaerobically.

Figure 2 shows an athlete after a race.

(Source: © voronaman/Shutterstock)

Figure 2

Explain how aerobic respiration provides energy for running.

(2)

The products of aerobic respiration are water and carbon dioxide. It increases the heart rate. It takes place in the mitrochonaria and provides oxygen to run.

ResultsPlus
Examiner Comments

This scored one mark for the products of aerobic respiration and one mark for in the mitochondria.

ResultsPlus
Examiner Tip

State where a reaction occurs as well as giving reactants and products where possible.

(b) During a race, athletes respire aerobically and anaerobically.

Figure 2 shows an athlete after a race.

(Source: © voronaman/Shutterstock)

Figure 2

Explain how aerobic respiration provides energy for running.

(2)

Oxygen + glucose → carbon dioxide + water

Aerobic respiration uses oxygen, meaning oxygen travels to working muscles (for example in the legs) in the bloodstream, allowing them to respire which provides energy.

ResultsPlus
Examiner Comments

This gained full marks for the word equation for respiration.

Question 1(c)iii

Candidates were asked what would happen to the movement if the four maggots were replaced with two maggots. This was answered very well with almost all candidates with them stating that the drop would move more slowly due to there being fewer maggots respiring or less oxygen being absorbed.

(iii) The investigation was repeated with two maggots.

Explain how the movement of the drop of coloured liquid would be affected if the investigation was repeated using fewer maggots.

(2)

The movement of the drop of coloured liquid will move at a slower rate because if their is less maggots there is less respiration taking Place and therefore less Produce being made

ResultsPlus
Examiner Comments

This gained a mark for slower rate of movement and one for less respiration. To obtain the product or reactant mark they would need to have stated less oxygen used or less carbon dioxide produced.

ResultsPlus
Examiner Tip

Name the products and reactants of reactions you refer to in answers.

(iii) The investigation was repeated with two maggots.

Explain how the movement of the drop of coloured liquid would be affected if the investigation was repeated using fewer maggots.

(2)

it would be a slower reaction due to less overall respiration.

ResultsPlus
Examiner Comments

A slower reaction was not accepted. It asked about the movement of the coloured liquid. Less respiration was credited one mark.

Question 1(c)i-ii

ci - This question asked for the reason for soda lime being used in the respiration experiment. This is a core practical in the specification and the mark was awarded for soda lime absorbing the carbon dioxide. Some incorrect responses stating the soda lime absorbed oxygen or provided oxygen or carbon dioxide.

cii - For this question candidates needed to draw on the capillary tubing where the drop of liquid would be after a certain time. The drawing should be with the leading edge at 30 although some benefit of doubt was given where 30 was clearly the centre of the drawn mark. Common errors included the wrong direction of movement with the bubble being drawn at 10mm.

(c) The rate of respiration of maggots was investigated using the equipment shown in Figure 3.

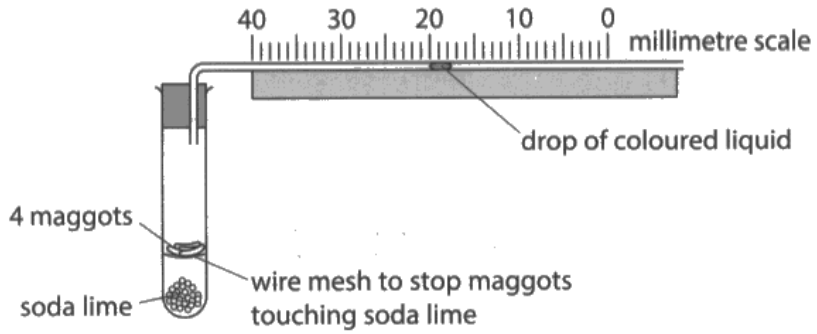


Figure 3

(i) State the reason why the soda lime is placed in the test tube.

(1)

It absorbs carbon dioxide

(ii) The drop of liquid in Figure 3 is at 20 mm.

The drop of coloured liquid moved at a mean rate of 2 mm per minute.

Draw, on Figure 4, the new position of the bubble after the five minutes.

(1)

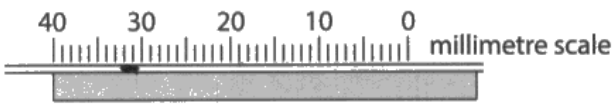


Figure 4

ResultsPlus
Examiner Comments

(i) gained the mark for absorbs carbon dioxide. Removing or reacting with carbon dioxide were also accepted. (ii) Does not gain the mark as the bubble is not in the correct position.

(c) The rate of respiration of maggots was investigated using the equipment shown in Figure 3.

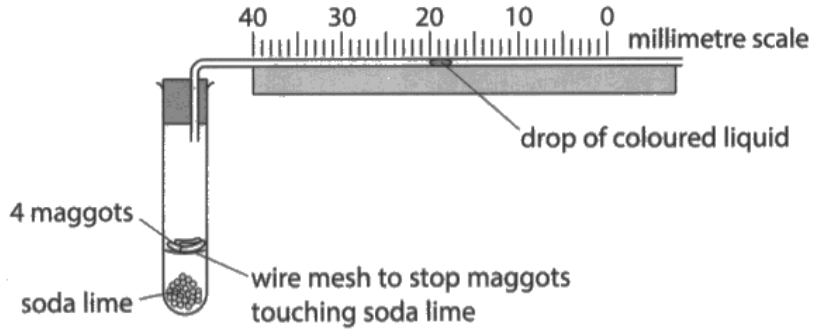


Figure 3

(i) State the reason why the soda lime is placed in the test tube.

(1)

To suck up the Carbon dioxide respired from the maggots

(ii) The drop of liquid in Figure 3 is at 20 mm.

The drop of coloured liquid moved at a mean rate of 2 mm per minute.

Draw, on Figure 4, the new position of the bubble after the five minutes.

(1)

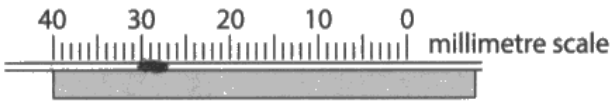


Figure 4

ResultsPlus
Examiner Comments

(i) Suck up the carbon dioxide was awarded the mark as it is the idea of removal. (ii) Gained the mark for the front of the bubble being in line with 30.

(c) The rate of respiration of maggots was investigated using the equipment shown in Figure 3.

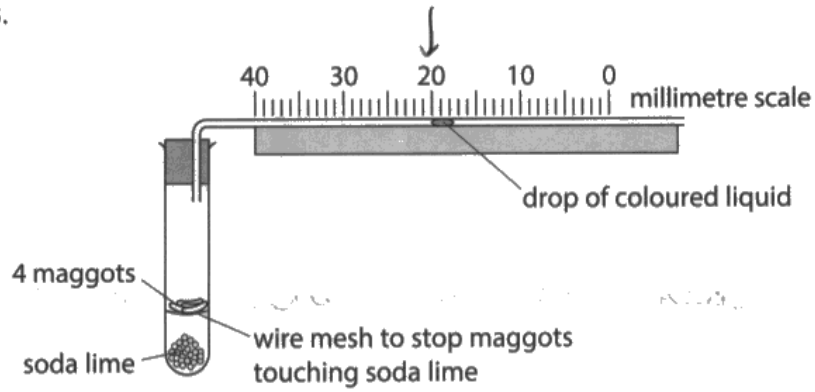


Figure 3

(i) State the reason why the soda lime is placed in the test tube.

(1)

to prove the ~~positive~~ presence of carbon dioxide as it turns cloudy.

(ii) The drop of liquid in Figure 3 is at 20 mm.

The drop of coloured liquid moved at a mean rate of 2 mm per minute.

Draw, on Figure 4, the new position of the bubble after the five minutes.

(1)

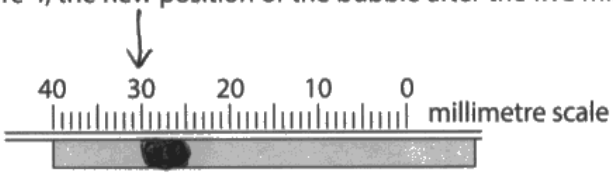


Figure 4

ResultsPlus
Examiner Comments

Detecting carbon dioxide was not credited for (i) but the arrow indicating the location was credited for (ii).

Question 1(c)iv

This question asked how to improve the results to make them more reliable. We accepted just repeating the experiment or repeating to obtain a mean. Marks were lost when candidates suggested that a variable should be changed, such as using a different number of maggots. It is important that no variables are changed for reliable results.

(iv) State **one** way this investigation can be improved to obtain more reliable results.

(1)

try it multiple times

ResultsPlus
Examiner Comments

This is the idea of repeating the investigation and scored the mark.

(iv) State **one** way this investigation can be improved to obtain more reliable results.

(1)

add more maggots

ResultsPlus
Examiner Comments

This is changing a variable which would not lead to a reliable results.

(iv) State **one** way this investigation can be improved to obtain more reliable results.

(1)

repeat with the same amount of maggots and measure average mean.

ResultsPlus
Examiner Comments

This refers to controlling a variable which in isolation was not credit worthy but it refers to a repeat as well as a mean.

Question 2(a)i

This question asked candidates to state what the term indigenous meant. The mark scheme included the idea of them being native species or species from the country of origin. We also accepted an idea of the fact that they have always grown there. Incorrect answers mainly described non-indigenous species.

2 (a) In 2018, all the plants were removed from the soil in a 1000 m^2 area.

A wall was built around this area to keep people out.

In 2019, three species of plants were recorded growing in this area.

Two of these species were indigenous.

(i) State what is meant by the term 'indigenous'.

(1)

They are not originally from that area

ResultsPlus
Examiner Comments

This was the most common error seen, describing a non-indigenous species.

2 (a) In 2018, all the plants were removed from the soil in a 1000 m^2 area.

A wall was built around this area to keep people out.

In 2019, three species of plants were recorded growing in this area.

Two of these species were indigenous.

(i) State what is meant by the term 'indigenous'.

(1)

Native

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Examiner Comments

This was sufficient for the mark for the meaning of the term indigenous.

2 (a) In 2018, all the plants were removed from the soil in a 1000 m^2 area.

A wall was built around this area to keep people out.

In 2019, three species of plants were recorded growing in this area.

Two of these species were indigenous.

(i) State what is meant by the term 'indigenous'.

(1)

specific to the area they are growing in.

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This is not the meaning of the term indigenous as the species is not necessarily specific to that area.

Question 2(a)ii

This question asked for a piece of sampling equipment to measure plant species and we required a quadrat for the answer. Other acceptable answers included a belt or line transect or a grid. Some responses stated a square but this was not awarded a mark unless it was qualified with a measurement.

(ii) Name **one** piece of equipment that could be used to sample the number of indigenous plants in this area.

(1)

Quadrat

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A quadrat is the piece of equipment needed to sample plants.

Question 2(b)i

Candidates were asked to describe the trend in the data and the data showed that the species were increasing. This was answered well by most candidates.

Question 2(b)iii

The question asked about how a species could be outcompeted. Marks were awarded for the idea that the plants were taller or bigger or had larger leaves / roots as well as that they grew more followed by a justification including access to more light, more photosynthesis or more water/mineral ions absorbed. Nutrients were accepted for mineral ions.

(iii) Explain **one** way that this species could have out-competed species B.

(2)

It could have been taller and recieved more sunlight for Photosynthasis meaning Prehaphs speasies B would have been in shade preventing it from getting enerys sunlight

ResultsPlus
Examiner Comments

This explanation links taller to more sunlight or photosynthesis gaining full marks.

(iii) Explain **one** way that this species could have out-competed species B.

(2)

plants fight for nutrients in soil, light from sun and water. If species A had plants in close proximity to B, that reproduced quicker it is more likely that more plants that survive would be A. B would be shadowed.

ResultsPlus
Examiner Comments

This gained the marks as it has the idea that the species reproduced faster linked to the justification that they could obtain nutrients, light or water.

(iii) Explain **one** way that this species could have out-competed species B.

(2)

~~Species~~ The species in A are better adapteed ~~to~~ the environent ~~and~~ so they ~~able to~~ are more resistance than species in B so they will out compete species in B.

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Outcompetes is given in the question. Just the idea of better adapted or resistance was insufficient as it does not state what the plant was resistant to.

Question 2(b)iv

The question asked reasons why a new plant could have colonised an area surrounded by a wall. Any reasonable answer stating how seeds may have got in such as on animals, birds or overhanging trees was acceptable. Roots or shoots growing under or through the wall was also accepted.

(iv) Give **one** way that species H could have moved into the area.

(1)

pollenation through bees.

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Examiner Comments

Pollination is incorrect and was not accepted for a mark. It was a common misconception seen.

(iv) Give **one** way that species H could have moved into the area.

(1)

~~Birds excreting seeds as they the they above the area.~~

Birds excreting seeds as they ~~they~~ they over the area.

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Examiner Comments

Excretion of seeds by birds is an acceptable answer.

(iv) Give **one** way that species H could have moved into the area.

(1)

Planted by a human nearby + it spread

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This was insufficient as there is no indication of how it has spread. References to planted by humans or that humans moved them into the area was ignored unless they clarify how this would occur eg brought in on muddy boots during sampling.

Question 2(c)

This question asked how the plants got water from the soil. Through root hair cells or roots by osmosis across a partially permeable membrane down a concentration gradient was also acceptable for the marks. The most common response was through the roots by osmosis for the 2 marks. Some candidates lost marks for describing how water moved through the plant and not into it.

(c) Plants also need water to grow.

Explain how water is absorbed into the plant.

(2)

transSormation. trans Sormation is moremeht
oS water throush osmosis but plant
go ~~oyot~~ aginst Sravity so it reqyne energy

ResultsPlus
Examiner Comments

This candidate has confused transformation with transpiration which is the movement through a plant but it did gain the mark for osmosis.

(c) Plants also need water to grow.

Explain how water is absorbed into the plant.

(2)

The specialised cell : Root hair cell is a cell with a semipermeable membrane and it absorbs water in plants through osmosis.

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This shows a good understanding of how water is absorbed into a plant with three marking points given for maximum marks.

Question 3(a)i

Diffusion was the correct answer so no other answers were acceptable. Common misconceptions included osmosis and dilution.

Question 3(a)ii

Candidates were asked to give two variables to control during the diffusion experiment. Correct responses included volume of water, beaker, temperature, volume or concentration of the food colouring, volume or size of the drop or size of the pipette used. Candidates are still on occasion using the term amount rather that the correct scientific measurement which is not accepted.

(ii) A student asked if different food colourings spread evenly in the same amount of time.

Give **two** variables that would need to be controlled if the investigation was repeated with different food colourings.

(2)

1 Temparature of water

2 Volume of beaker

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Both these are variables that need to be controlled gaining full marks.

(ii) A student asked if different food colourings spread evenly in the same amount of time.

Give **two** variables that would need to be controlled if the investigation was repeated with different food colourings.

(2)

1 amount of food colouring used

2 amount of water in the beaker

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The amount of food colouring or water was not accepted; we require volume and accepted mass as these are the measurements. The amount of food colouring drops was accepted as this is a number value.

(ii) A student asked if different food colourings spread evenly in the same amount of time.

Give **two** variables that would need to be controlled if the investigation was repeated with different food colourings.

(2)

1 volume of water

2 size of the drops of food colouring used

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This gains two marks. They have used the term volume for the water and the size of the drops is a controlled variable to ensure that if 5 drops are added the volume of food colouring is the same.

Question 3(b)i

This question involved drawing a graph from a table of data. The marks were awarded for the correct axes labelled with units, for the independent variable being plotted on the x axis and the time on the y axis, a linear scale on both axes as well as correctly plotted points and line drawn. If there was no labelling on the axis neither of the first two points were awarded. A range of scores were awarded with marks lost for not labelling axis with units or plotting time on the x axis. Fewer errors were seen plotting the points but some graphs were extrapolated with a curve, which is incorrect.

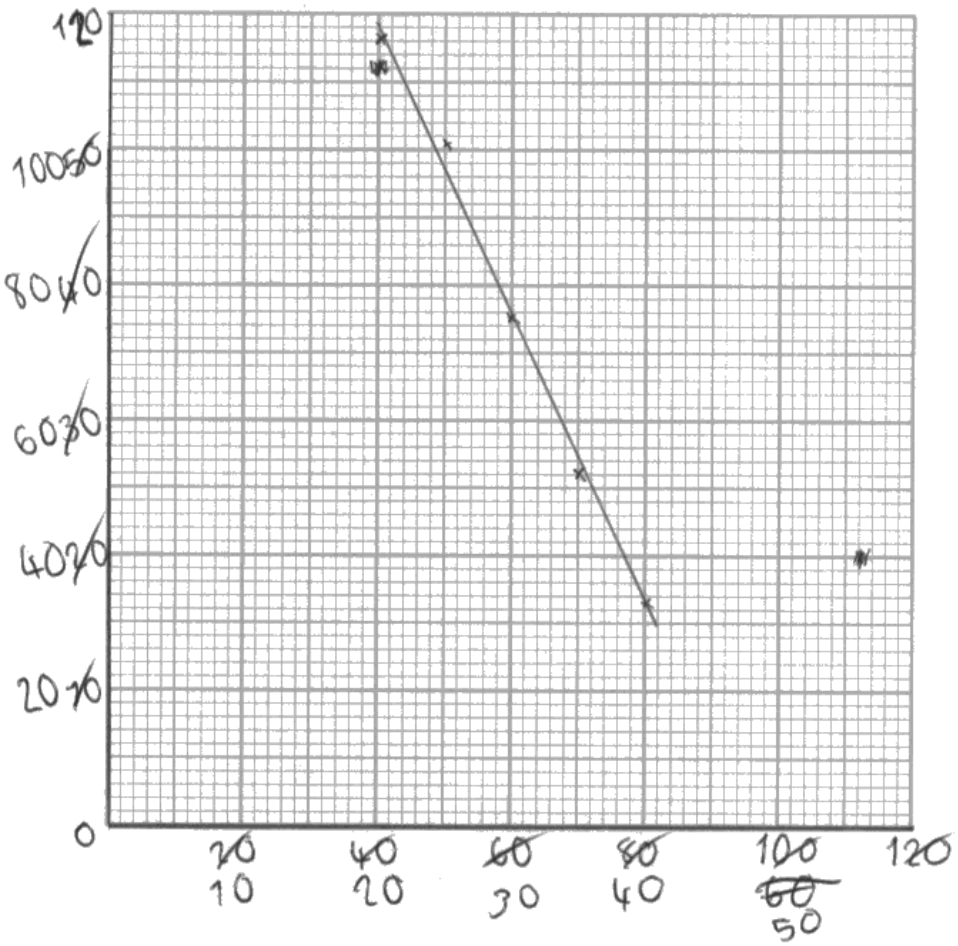
(b) The teacher repeated this process with water at different temperatures. Figure 7 shows the results of this experiment.

water temperature in °C	time taken for food colouring to spread evenly through the water in seconds
20	116
25	101
30	75
35	52
40	33

Figure 7

(i) Draw a line graph to show the results in Figure 7.

(4)



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Examiner Comments

This response was limited to a maximum of two marks as they did not labelled the axis, the mark for the x/y axis was not deduced from numbers. This graph has two marks for linear scale, correct plots and line of best fit. The errors on the plots have been crossed out and correctly extrapolated straight lines were accepted.

(b) The teacher repeated this process with water at different temperatures. Figure 7 shows the results of this experiment.

water temperature in °C	time taken for food colouring to spread evenly through the water in seconds
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Figure 7

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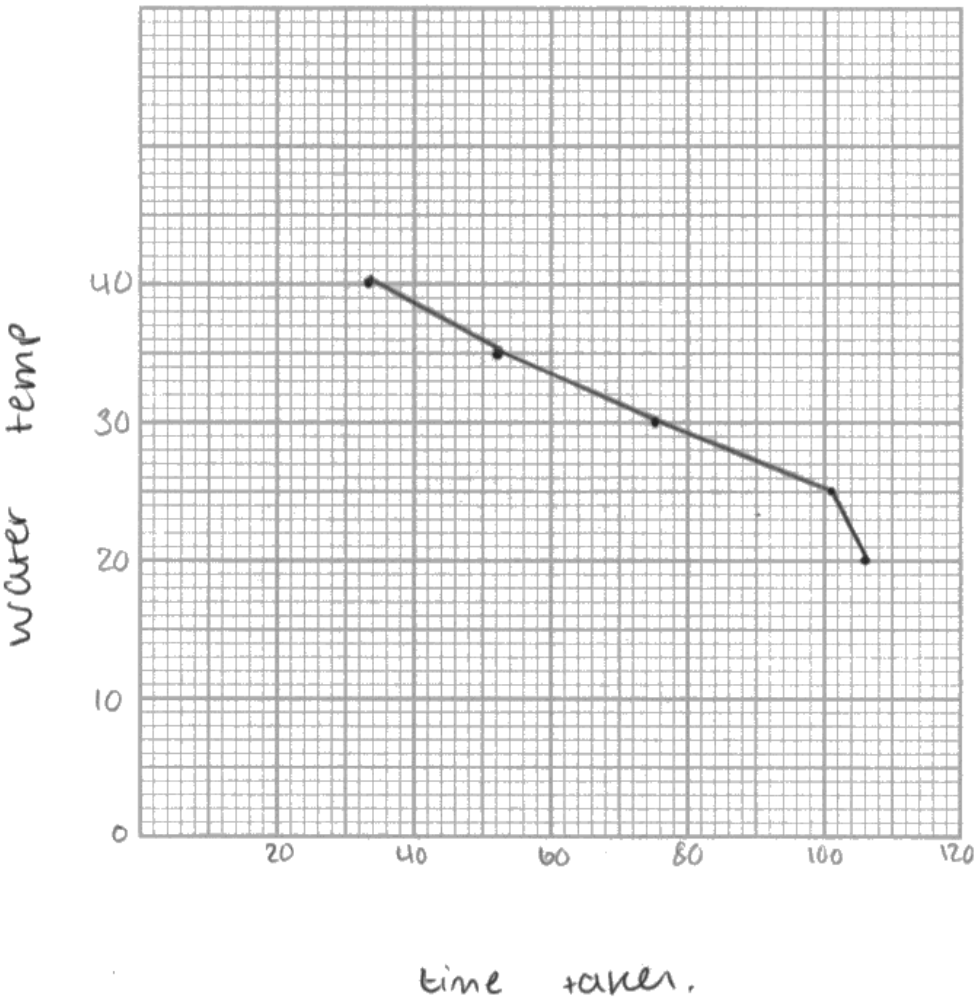

ResultsPlus
Examiner Comments

This response was limited to a maximum of three marks as it has the X and Y axis incorrect The response does not score for the labels as there are no units. It scores one mark for a linear scale on both axes. The 116 is incorrectly plotted so there is no mark for plotting. A dot-to-dot line or line of best fit was accepted as well as correctly extrapolated lines.

(b) The teacher repeated this process with water at different temperatures. Figure 7 shows the results of this experiment.

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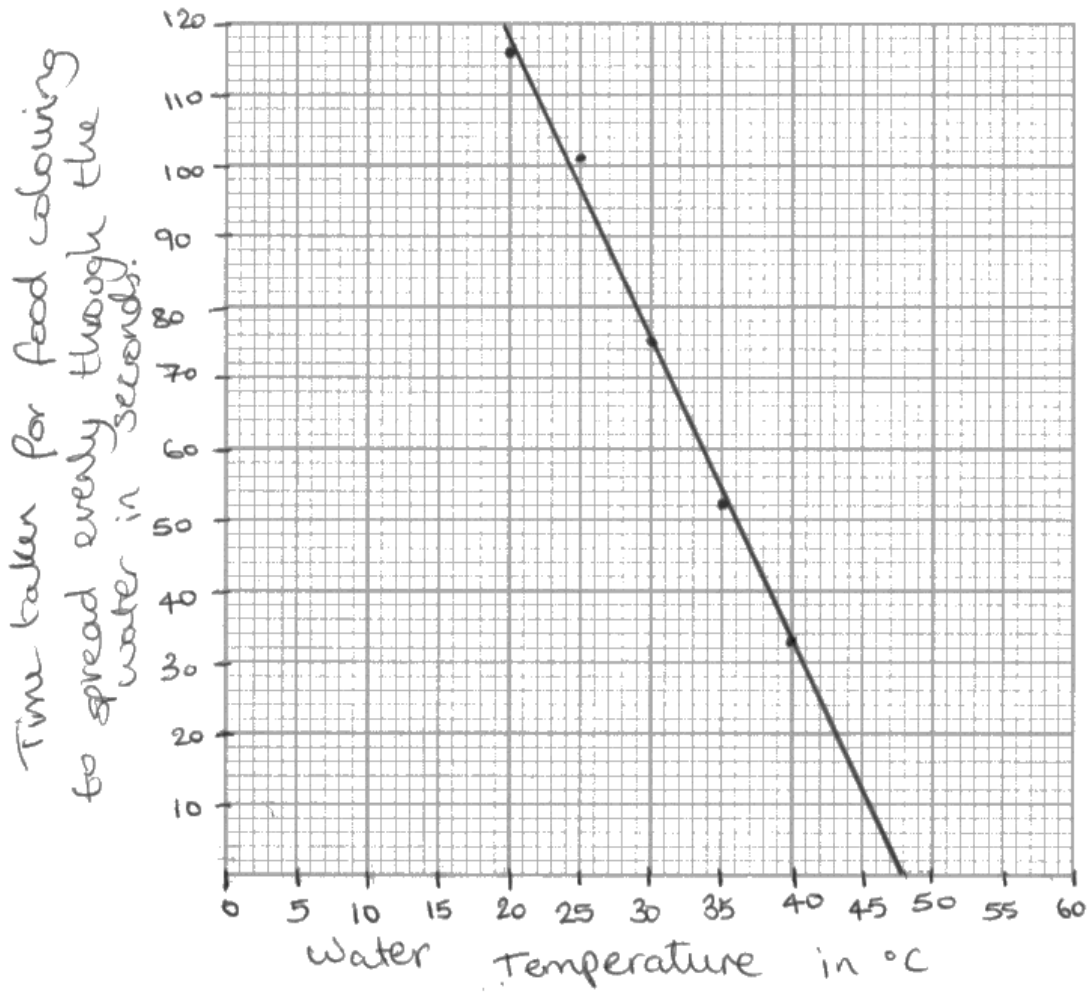


ResultsPlus
Examiner Comments

This scored maximum marks. The axis is correct and labelled with a linear scale. The plots are correct and a line of best fit is included. It has been extrapolated but correctly.

Question 3(b)ii

This question was answered well by most candidates. They were asked to explain why the time taken for diffusion decreased. Correct explanations included due to a temperature increase, particles moving faster due to more kinetic energy. Also accepted was particles diffuse faster or spread out faster or even more collisions. Some candidates just referred to increased energy and not kinetic energy which was required for the mark.

(ii) **Explain why the time taken decreased.**

(2)

the concentration happened quicner as there was a higher temperature so the reaction happened quicker

ResultsPlus
Examiner Comments

This has one mark for higher temperature. The reaction increased was ignored but diffusion increases would have been accepted.

ResultsPlus
Examiner Tip

Be specific in your answers.

(ii) Explain why the time taken decreased.

(2)

- The increase in temperature increased the kinetic energy and rate of collision in the particles of the [illegible] and colouring
- This allowed less time for the particles to be spread

ResultsPlus
Examiner Comments

This response accurately uses key scientific terms and was awarded full marks.

(ii) Explain why the time taken decreased.

(2)

As the temperature of the water increases, so does the energy of the water particles (the move faster). This faster movement decreases the time taken as the particles mix / move the food colouring particles faster.

ResultsPlus
Examiner Comments

This has a mark for increasing temperature and a second for the particles move faster. Energy needed to refer to kinetic energy.

Question 4(a)i

The question related to the diagram and asked for the number of guard cells present which was 8. The most common misconception was an answer of 4 which would have been the number of stomata. A few candidates counted all the cells visible instead of just the guard cells.

Question 4(a)ii

This question asked for the gases entering and leaving the stomata during the daylight. Gases leaving the stomata were either oxygen or water vapour. The gas entering the stomata was carbon dioxide. Chemical formulae were accepted if they were correctly written.

Question 4(a)iii

The question asked why the stomata close, the response expected was to prevent water loss or to prevent the plant drying out or to prevent transpiration. Some responses outlined the idea that it was to stop photosynthesis from occurring which was not credited. Other responses that were awarded a mark referred to preventing pathogens entering the plant.

(iii) State why the stomata close.

(1)

To prevent too much transpiration causing too much water loss - water is needed for photosynthesis

ResultsPlus
Examiner Comments

To prevent / reduce transpiration was accepted and this response also has the idea of preventing too much water loss.

(iii) State why the stomata close.

(1)

to control the amount that comes in and out, and this happens whether it is in water or not.

ResultsPlus
Examiner Comments

This response is vague as it does not refer to what is coming in or out and did not obtain the mark.

(iii) State why the stomata close.

(1)

to make sure & nothing goes into the stomata at night (protects stomata)

ResultsPlus
Examiner Comments

This was not sufficient, that stomata close to prevent pathogens entering or named pathogens/microorganisms entering would have been credited.

Question 4(b)

This question asked how to view a prepared slide using a light microscope. Some candidates described how to prepare a slide rather than how to view it, this was not credited. It is vital that candidates read the question carefully to prevent this type of error. Expected answers included placing the slide on the stage, select the lowest objective lens, use the focusing wheel, then select a higher objective lens. Using the coarse or fine focus for the focusing wheel was credited and increasing the magnification scored a mark against using a higher objective lens.

(b) A student wanted to view the cross-section of a leaf on a prepared slide.

Describe how a light microscope would be used to observe this slide.

(3)

the slide would be placed on the stage and then the magnification would be changed. The resolution would then be changed by moving the stage up and down allowing the image to focus.

ResultsPlus
Examiner Comments

This had a mark for place on the stage and a second mark for focus. The magnification would be changed is not sufficient either marking point for magnification.

(b) A student wanted to view the cross-section of a leaf on a prepared slide.

Describe how a light microscope would be used to observe this slide.

(3)

~~Stain the leaf.~~
~~Place~~ Place cross section of leaf on slide.
Stain the ~~slide~~ leaf.
Place another slide on top.
Adjust zoom and the focus wheel until object is clear.

ResultsPlus
Examiner Comments

No marks were awarded for preparing a slide as the question does not ask for this. This response scored one for focusing.

Question 4(c)

This question asked how sugars were moved through the plant and it was well answered by the majority of candidates. Expected responses included the movement of sucrose, through the phloem, by translocation, using active transport, for bidirectional flow. Xylem and transpiration were rejected against phloem and translocation.

(c) Sugars are transported from the leaves to the rest of the plant.

Explain how sugars are moved through the plant.

(2)

Sugars are produced in the leaves during Photosynthesis, the sugars diffuse through the plant and travel through the stem to be converted into stored glucose,

ResultsPlus
Examiner Comments

This was not sufficient as it refers to sugar and not sucrose and does not have the idea of bidirectional flow.

(c) Sugars are transported from the leaves to the rest of the plant. magnification

Explain how sugars are moved through the plant.

(2)

through the phloem via trans-
location, the phloem is in the
stem of the plant, it is made up
of living cells and moves sugars
(e.g. sucrose) up and down the
plant (in this case upwards into leaves)

ResultsPlus
Examiner Comments

This illustrates a comprehensive understanding of how sugars are moved through a plant with reference to phloem, translocation, sucrose and up and down the plant for bidirectional flow.

(c) Sugars are transported from the leaves to the rest of the plant.

Explain how sugars are moved through the plant.

(2)

- Through phloem
- From leaves
- By transpiration
- ~~All around the plant~~ To the rest of plant

ResultsPlus
Examiner Comments

This gained one mark for phloem. From leaves was not sufficient for bidirectional flow. Transpiration is a reject against translocation. This means that if they said by transpiration and translocation then the translocation mark would not have been awarded.

Question 5(a)ii

Candidates were asked to explain the role of the bicuspid valve on the left side of the heart. Expected answers included to prevent the backflow of blood or to allow blood to flow into the left ventricle or so blood flows in one direction. For the second mark point they had to state that blood will not flow back into the left atrium or into Q as labelled on the diagram of the heart. Most candidates gained one mark for preventing backflow but did not always refer the chambers involved.

(ii) The heart has a valve called the bicuspid valve between chamber Q and chamber R.

Explain the role of this valve.

(2)

Prevent backflow of blood

Prevent blood re-entering the left atrium

ResultsPlus
Examiner Comments

This gains two marks. Although they refer to backflow, the idea of stopping blood re-entering the left atrium is worth both marks in isolation.

(ii) The heart has a valve called the bicuspid valve between chamber Q and chamber R.

Explain the role of this valve.

(2)

It allows ~~oxygen~~ blood to pass through and prevents backflow of blood. Allows blood to pass through left atrium to left ventricle

ResultsPlus
Examiner Comments

This gains one mark for preventing backflow or allowing blood to pass from left atrium to left ventricle. It needed to state that the prevention of backflow is into the left atrium for the second mark.

Question 5(b)

This question was answered very well with the majority of candidates gaining at least two marks and many higher achieving candidates gaining full marks. The question asked why the heart rate increased during exercise. The expected answers included the heart pumping blood faster or that there was more blood flow, to provide more oxygen/glucose, for increased respiration, to get more energy to the muscles and to remove more carbon dioxide. Many candidates used the phrase to provide more oxygenated blood and this gained them two marks.

(b) Explain why heart rate increases during exercise.

(3)

Heart rate increases as more energy is needed. Respiration increases so more blood needs to be pumped around the body as blood carries the oxygen needed for respiration. Due to the person doing exercise more O_2 is needed so the heart rate increases.

ResultsPlus
Examiner Comments

This did not gain the mark for more energy as it was not linked to muscles. Three marks were awarded for respiration increases and more blood needs to be pumped linked to carrying oxygen.

(b) Explain why heart rate increases during exercise.

(3)

So that more oxygen and glucose can be pumped ~~with~~ around the body - to cells - in the the bloodstream for more respiration to provide the body with more energy.

More oxygen and glucose is one mark and either would be sufficient. Respiration is a second mark as the response implies that there is more needed. Providing the body with more energy is not awarded as it needs to be linked with muscles.

Question 5(c)i

This question required the calculation of a percentage using data given in the table. They were then asked to give their answer to 3 significant figures. The majority of candidates were able to complete the calculation but marks were lost by leaving the answer as 123.5 or giving it as 123 rather than 124.

(c) (i) Every person has a maximum heart rate.

Figure 10 shows how different types of activity affect a person's heart rate and the type of respiration they are using during that activity.

	walking	jogging	cross-country running	running fast (sprinting)
percentage of maximum heart rate	50%	65%	75%	90%
type of respiration	aerobic	aerobic	aerobic and anaerobic	aerobic and anaerobic

Figure 10

A person had a maximum heart rate of 190 beats per minute.
Calculate the heart rate of this person when they are jogging.

Give your answer to 3 significant figures.

(3)

65% = jogging

65% of 190 = 123.5

3 s.f = 124

124 beats per minute

ResultsPlus
Examiner Comments

This is clearly a correct method and the answer rounded to 3 significant figures.

ResultsPlus
Examiner Tip

Always show your workings out for calculations.

(c) (i) Every person has a maximum heart rate.

Figure 10 shows how different types of activity affect a person's heart rate and the type of respiration they are using during that activity.

	walking	jogging	cross-country running	running fast (sprinting)
percentage of maximum heart rate	50%	65%	75%	90%
type of respiration	aerobic	aerobic	aerobic and anaerobic	aerobic and anaerobic

Figure 10

A person had a maximum heart rate of 190 beats per minute.
Calculate the heart rate of this person when they are jogging.

Give your answer to 3 significant figures.

(3)

65% of x = 190

$\left(\frac{190}{65}\right) \times 100 = 292$

292 beats per minute

ResultsPlus
Examiner Comments

This was awarded one mark for an incorrect calculation being rounded to three significant figures.

(c) (i) Every person has a maximum heart rate.

Figure 10 shows how different types of activity affect a person's heart rate and the type of respiration they are using during that activity.

	walking	jogging	cross-country running	running fast (sprinting)
percentage of maximum heart rate	50%	65%	75%	90%
type of respiration	aerobic	aerobic	aerobic and anaerobic	aerobic and anaerobic

Figure 10

A person had a maximum heart rate of 190 beats per minute.
Calculate the heart rate of this person when they are jogging.

Give your answer to 3 significant figures.

(3)

10% = 19
5% = 9.5
60% = 114.0
5% + 9.5
123.5

123.5

[redacted] 123 beats per minute

ResultsPlus
Examiner Comments

This has the correct calculation but the answer has been incorrectly rounded to three significant figures.

ResultsPlus
Examiner Tip

Follow the rules for rounding numbers, 5 is rounded up.

Question 5(c)ii

This targeted the higher ability candidates on the paper and required an explanation for how the structure related to function for erythrocytes. The lower targeted mark was given for no nucleus. Marks were awarded for biconcave shape to increase the surface area or to allow more diffusion, flexible to fit through capillaries, haemoglobin to bind oxygen and thin so a short diffusion pathway. No nucleus and biconcave for large surface area were the most popular answers given.

(ii) Erythrocytes (red blood cells) transport oxygen to respiring cells.

Explain how erythrocytes (red blood cells) are adapted to carry and release oxygen.

(3)

• B: concave shape to increase surface area so more oxygen can be carried.

• No nucleus so more haemoglobin ✗ which then means it can carry more oxygen.

• Flexible so it can squeeze through capillaries and narrow blood bessels.

ResultsPlus
Examiner Comments

This scored full marks and illustrates a higher level response. The marks were awarded for biconcave for larger surface area, no nucleus and the link between haemoglobin and oxygen.

ResultsPlus
Examiner Tip

If the command word is explain always justify the statements that you make in your answer.

(ii) Erythrocytes (red blood cells) transport oxygen to respiring cells.

Explain how erythrocytes (red blood cells) are adapted to carry and release oxygen.

(3)

They are biconcave in shape which allows them to have a larger surface area to carry more oxygen. They have no nucleus which also allows them to carry more oxygen. They are small in size which allows them to ~~sp~~ squeeze in small spaces. ~~small spaces~~

ResultsPlus
Examiner Comments

These were the most frequent marks awarded for biconcave linked to surface area and no nucleus. Small was not linked to capillaries and was not credited.

(ii) Erythrocytes (red blood cells) transport oxygen to respiring cells.

Explain how erythrocytes (red blood cells) are adapted to carry and release oxygen.

(3)

Broncave disc shape - maximizes surface area and stays intact under high pressures in the blood, maximizing how much ~~[illegible]~~ oxygen binds to haemoglobin due to large surface area. Haemoglobin also binds to oxygen which carries the oxygen in the blood cell, lots of haemoglobin

ResultsPlus
Examiner Comments

This has biconcave shape linked to increased surface area and haemoglobin binding oxygen for two marks. These marking points required the feature and the linked explanation point.

Question 6(a)i

This question gave a table of data and asked for candidates to compare and contrast the data before and after the menopause. This question was answered well with many candidates gaining all three marks. One mark was awarded for the idea that all the hormones named decreased after the menopause. Other marks were given for calculating the reduction in each of the hormones, with oestrogen down by 10pg/mL, progesterone down by 10.6ng/mL and testosterone down by 19ng/dL. Calculated percentages for these values were also accepted for the mark points. Candidates typically either identified that all three hormones had reduced for one mark or calculated the decreases for all three gaining full marks.

6 (a) The menopause occurs when the menstrual cycle stops.

Figure 11 shows the hormone concentrations in the blood before the menopause and after the menopause.

hormone	mean hormone concentration before the menopause	mean hormone concentration after the menopause
oestrogen	33 pg/mL	23 pg/mL
progesterone	11 ng/mL	0.4 ng/mL
testosterone	35 ng/dL	16 ng/dL

Figure 11

(i) Compare and contrast the hormone concentrations before and after the menopause.

(3)

- Overall all hormones concentrations have decreased
- oestrogen has decreased from 33pg/mL to 23pg/mL
- Whereas testosterone has decreased from 35 ng/dL to 16ng/dL
- whereas progesterone has decreased from 11ng/mL to 0.4 ng/mL

ResultsPlus
Examiner Comments

This only gained one mark as the majority of the answer just repeats the information from the table.

ResultsPlus
Examiner Tip

Use mathematical skills when given data to analyse.

6 (a) The menopause occurs when the menstrual cycle stops.

Figure 11 shows the hormone concentrations in the blood before the menopause and after the menopause.

hormone	mean hormone concentration before the menopause	mean hormone concentration after the menopause
oestrogen	33 pg/mL	23 pg/mL
progesterone	11 ng/mL	0.4 ng/mL
testosterone	35 ng/dL	16 ng/dL

Figure 11

(i) Compare and contrast the hormone concentrations before and after the menopause.

(3)

All concentrations decrease. Oestrogen decreases by 10 pg/mL, progesterone decreases by 10.6 ng/ML and testosterone decreases by 19 ng/dL. From this we can conclude testosterone levels decrease the most from before and after menopause.

ResultsPlus
Examiner Comments

This scored full marks as the differences in the hormone concentrations are calculated and linked to the idea of them decreasing.

6 (a) The menopause occurs when the menstrual cycle stops.

Figure 11 shows the hormone concentrations in the blood before the menopause and after the menopause.

hormone	mean hormone concentration before the menopause	mean hormone concentration after the menopause
oestrogen	33 pg/mL	23 pg/mL
progesterone	11 ng/mL	0.4 ng/mL
testosterone	35 ng/dL	16 ng/dL

Figure 11

(i) Compare and contrast the hormone concentrations before and after the menopause.

(3)

Hormone concentrations after menopause decrease in all the different hormones but in progesterone it is a very big decrease in the concentration

ResultsPlus
Examiner Comments

This only gained one mark for the hormones decreasing.

ResultsPlus
Examiner Tip

Consider the number of marks available for a question to judge whether your answer is likely to be sufficiently detailed.

Question 6(a)ii

This question asked for the roles of FSH and LH in the menstrual cycle. This was targeted at the higher ability candidates as the specification statement is higher. FSH should have been linked to the idea that it stimulated the follicle to mature causing the egg to mature and stimulated the production of oestrogen. LH should have been linked to ovulation and the formation of the corpus luteum. There were some mixed responses mixing up the roles of LH and FSH or linking them to effects on the uterus lining.

(ii) Explain the roles of FSH and LH in the menstrual cycle.

(3)

FSH is released from the ~~Pituary~~ pituary gland and this matures the egg cell. LH is also released from the pituary gland and it ~~forms~~ stimulates the corpus ~~luteal~~ luteam which produces progesterone which is vital for the menstrual cycle. LH ~~also~~ also moves the ovary down the fallopian tube.

ResultsPlus
Examiner Comments

This has a mark for FSH matures the egg and a second for LH stimulates the corpus luteum. The ovary down the fallopian tube is incorrect.

(ii) Explain the roles of FSH and LH in the menstrual cycle.

(3)

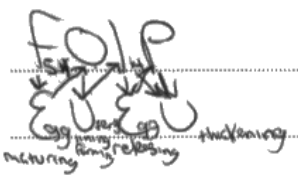
FSH and LH are ~~used~~ released to stimulate the ovaries, to produce eggs in the uterus. If the egg is fertilised then the uterus lining stays however if not oestrogen is released and breaks the uterus lining, causing a period.

ResultsPlus
Examiner Comments

There is no creditworthy response here. Production of eggs is incorrect. The marks are for maturing or stimulating the eggs. They are produced during gestation.

(ii) Explain the roles of FSH and LH in the menstrual cycle.

(3)



FSH causes the egg cell to mature which makes oestrogen to lighten making the uterus lining thicken and ~~by doing~~ so makes LH increase, causing the egg cell to release.

This scores full marks. It is not structured well but the scientific detail is clear for matures the egg cell, makes oestrogen and release of the egg cell linked to the correct hormone.

Use FOLP to remember the order of the hormones for the menstrual cycle.

Question 6(b)

This question included a graph showing glucose concentrations for a person with type 2 diabetes and for a person who did not have type 2 diabetes. The question asked them to explain how glucose was controlled for a person with type 2 diabetes and a person who did not have type 2 diabetes and to include information from the graph in their answer. The levels were gained by details about how glucose in controlled in the blood by the pancreas releasing insulin to convert glucose to glycogen which is stored in the liver/muscles so lowering blood glucose levels. Or the release of glucagon from the pancreas to convert glycogen back to glucose to raise blood glucose levels for a person without type 2 diabetes. In addition to this the fact that the cells for a person with type 2 diabetes are not responsive to insulin and therefore they have to control their blood glucose with medication, diet and exercise. To get to the top of the level this information had to be linked to data from the graph to illustrate the point. To attain level 3 there needed to be detail about both sets of people and to get to the top of the level this needed to be linked to the graph with insulin and glucagon referenced. For level 2 they could give brief details of both people or a detailed description of how glucose is controlled for a person with type 2 diabetes or for a person who does not have type 2 diabetes.

*(b) Figure 12 shows the blood glucose concentrations for a person who has type 2 diabetes and a person who does not have type 2 diabetes.

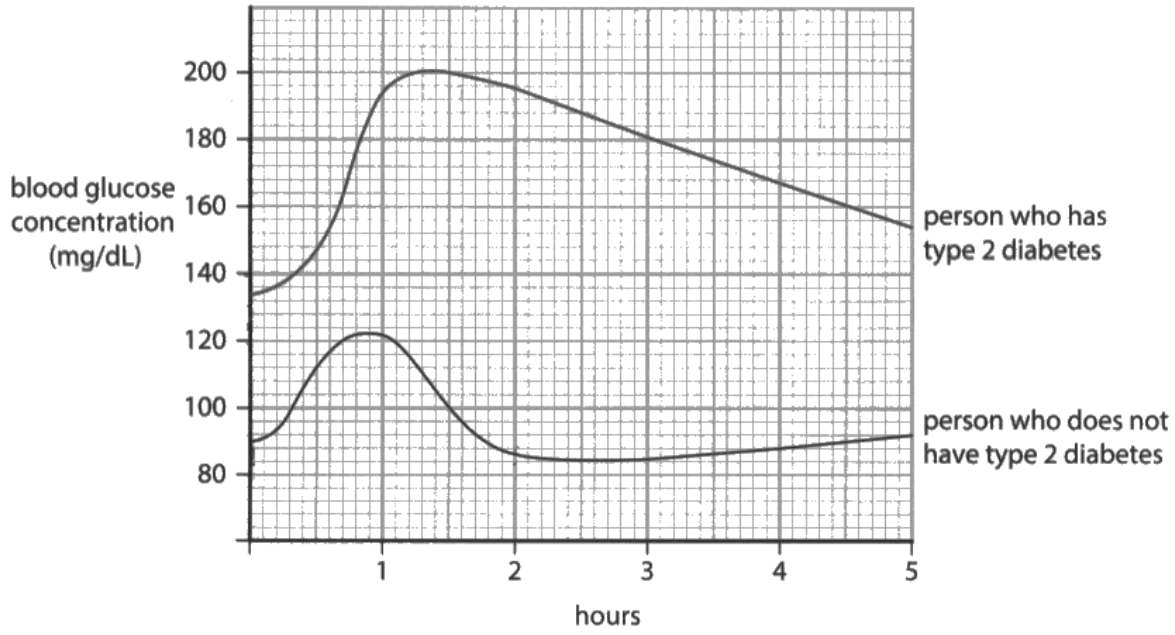


Figure 12

Explain how glucose concentrations are controlled for a person with type 2 diabetes and a person who does not have type 2 diabetes.

Include information from Figure 12 in your answer.

(6)

In a person with type 2 diabetes glucose concencentration is controlled by injecting insulin into the bodey ~~after~~ when having high glucose concentrations. as shown in figure 12 the blood glucose concentrations spike massively going from 133mg/dL to 200mg/dL in just over 1 hour the concentration then slowly and steadily decreases after the person assumable ingects some insulin. Br

Where as in a person who does not have

~~have~~ diabetes their blood sugar only rises slightly as shown in figure 12, going from 90 mg/dL to 122 mg/dL in 1 hour however rather than there blood glucose decreasing steadily, the body can produce glycogen which turns the glucose into glycerol which is stored in the liver. As shown in figure 12 this happens very abruptly as the blood glucose conc. goes from 122 mg/dL to 86 mg/dL in 1 hour.

ResultsPlus
Examiner Comments

This is a level 2 response worth 4 marks for linking injecting insulin in the type 2 diabetic to lowering blood glucose and the response includes data from the graph. Although there is also some information on blood glucose regulation on page 2 it does not have sufficient detail and accuracy to gain level 3.

*(b) Figure 12 shows the blood glucose concentrations for a person who has type 2 diabetes and a person who does not have type 2 diabetes.

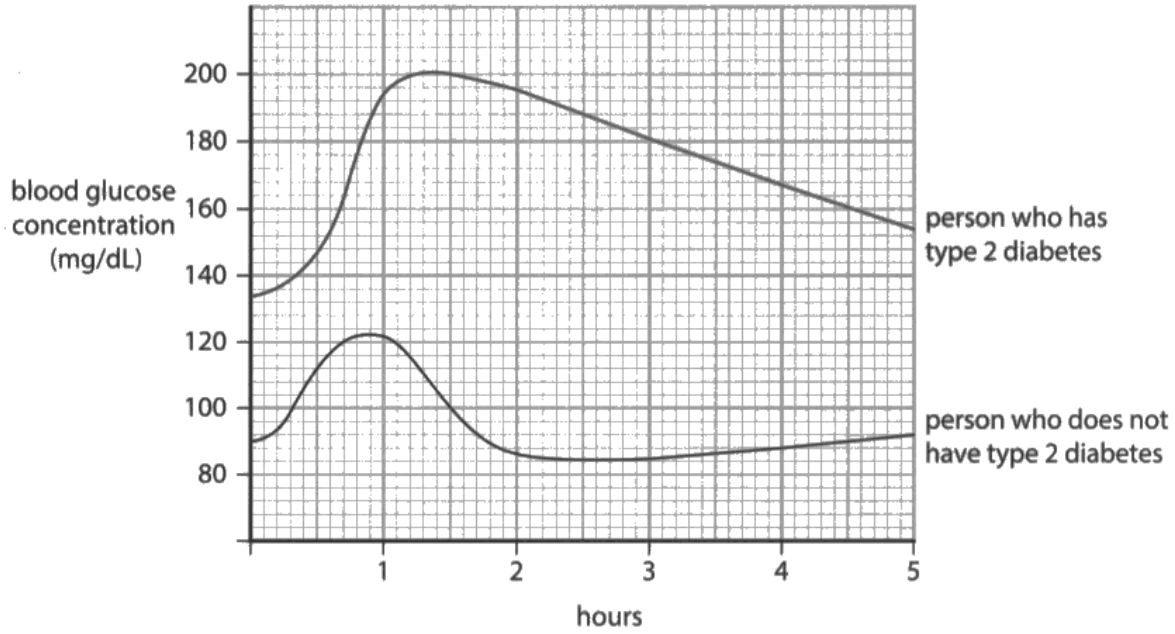


Figure 12

Explain how glucose concentrations are controlled for a person with type 2 diabetes and a person who does not have type 2 diabetes.

Include information from Figure 12 in your answer.

(6)

A person with type 2 diabetes need to inject themselves with insulin to allow them to regulate their blood glucose ~~concentration~~ concentration. In contrast a non-type 2 diabetic does not need to inject as their body already allows them to regulate their blood glucose ~~concentration~~ concentration automatically. ~~When~~ Their glucose in the liver converts to glycogen

This gained level 2 for content including needing to inject with insulin and conversion to glycogen. There is not enough detail on glucose regulation or the type 2 diabetic so level 3 is not awarded. The response is limited to three marks because there is no reference to data.

*(b) Figure 12 shows the blood glucose concentrations for a person who has type 2 diabetes and a person who does not have type 2 diabetes.

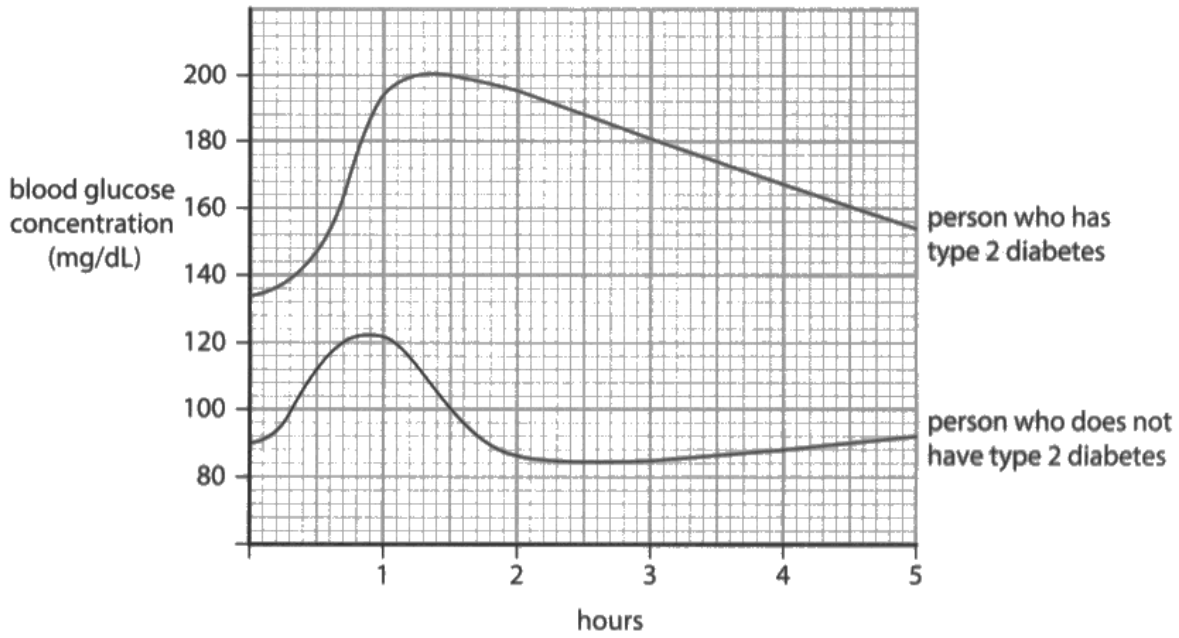


Figure 12

Explain how glucose concentrations are controlled for a person with type 2 diabetes and a person who does not have type 2 diabetes.

Include information from Figure 12 in your answer.

(6)

the person with type 2 diabetes is mainly because of his lifestyle, he gained diabetes. After a meal, the person with type 2 diabetes, his blood glucose concentration increases highly up to 200 mg/dL at ~~at~~ hour 1-2. It then decreases steadily down till approximately 156 mg/dL at hour 5. This is perhaps due to the person injecting ~~insulin~~ insulin in his body so it can go to the liver and convert the glucose to glycogen. Another way is through ~~exercise~~ exercise where the glucose will be used up for aerobic respiration. The type 2 diabetes is because the liver cells are resistant to insulin or Pancreas doesn't Produce enough insulin. whereas for the person who

does not have diabetes, his blood glucose concentration increases up to 122 mg/dL at hours c.q. It then very quickly decreases back to 86 mg/dL at hour 2. This is because after a meal, the Person's Pancreas detected this and therefore produced insulin which travels to liver to convert the glucose to glycogen and store it in the body. He doesn't have diabetes therefore his liver and Pancreas will function as per a normal.

This is a level 3 response worth 5 marks. They have details for the type 2 diabetic and blood glucose regulation including the conversion of glucose to glycogen. They have included data within their response but do not refer to the role of glucagon which limits them to the 5 marks.

*(b) Figure 12 shows the blood glucose concentrations for a person who has type 2 diabetes and a person who does not have type 2 diabetes.

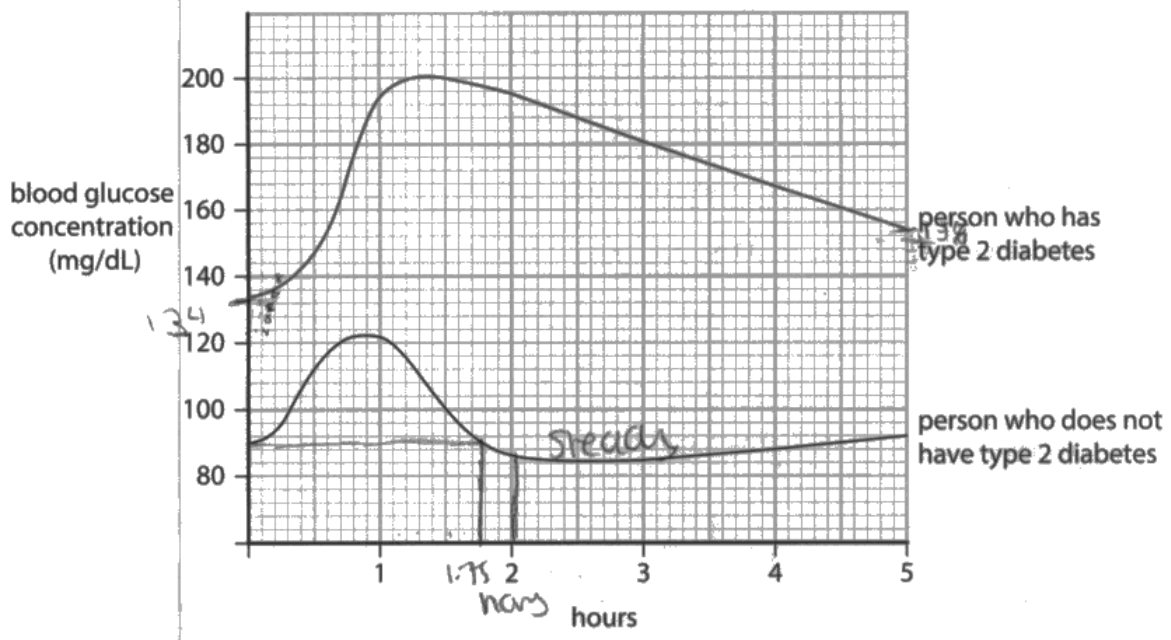


Figure 12

Explain how glucose concentrations are controlled for a person with type 2 diabetes and a person who does not have type 2 diabetes.

Include information from Figure 12 in your answer.

(6)

The person with type 2 diabetes experience a high surge in blood glucose concentration. His ~~concentral~~ blood glucose concentration goes from 134 mg/dL to 200mg/dL. A person with type two diabetes ~~has~~ is ~~receptor~~ resistant to insulin, meaning that insulin ~~does~~ secreted by the pancreas does not convert glucose into a glycogen store. People with type 2 diabetes can ~~change~~ use medicine They can change their diet, to limit carbohydrate intake which turns into glucose. They can increase their exercise as the body will ~~use up all~~ take response

person without type 2 diabetes

• Someone with no type of diabetes - Pancreas will secrete insulin. Then there is insulin and glucose in the blood stream. The insulin is transferred to the liver and body cells and less blood glucose decreases when blood glucose level is low the pancreas will secrete glucagon. Then there is glucagon and glucose in the bloodstream. In the liver the glycogen store is changed into glucose by the glucagon. This increases the amount of glucose in the blood. reduces

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

The person without type 2 diabetes blood glucose concentration returns to what it was before the rise in glucose in 1.75 hours. The body quickly uses insulin to reduced blood glucose levels.

The person with type 2 diabetes blood glucose levels does not return to 134mg/dl after 5 hours.

ResultsPlus
Examiner Comments

This is level 3. It has detail on blood glucose regulation including the role of glycogen, although it is in the context of what the type 2 diabetic person this is still acceptable. It also gives details on the type 2 diabetic including diet, exercise, medication and insulin resistance. It gained 6 marks because the response includes a reference to glucagon and data from the graph.

Paper Summary

Based on their performance on this paper, candidates should:

- ensure they answer the actual question in the paper. Written responses to a number of questions indicated that candidates used past papers as part of their revision process, **which is commendable**, but care must be taken to ensure that candidates answer the actual question in the paper, as although the knowledge may be similar the question is rarely identical.
- recognise that the word 'explain' means additional scientific information is needed that is linked to the answer given and the quantity of additional information given should reflect the number of marks awarded for the question.
- read the information given in the introduction to the question but avoid repeating it in the answer as it will not gain credit. Candidates should also read mathematical questions carefully to note whether an answer is required in a specific format, such as number of significant figures. They should ensure they consistently apply rules for rounding up numerical answers.
- ensure that when describing data from graphs and table they identify the trends shown and use data in written responses and use mathematical analysis such as mean calculation where possible. A mathematical manipulation of the data is nearly always likely to be creditworthy.
- always show the mathematical working when doing calculations as a mark can be awarded for errors carried forward.
- make sure that key scientific terms from the specification are understood including those for glucose regulation such as insulin and glucagon and also to ensure a good understanding of the core practical tasks identified within the specification.
- check the number of marks given for the question and ensure that they have included enough facts to match the marks awarded.
- consider the context of the question to ensure they apply their scientific knowledge to the situation they are being asked about.

Grade boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link: https://qualifications.pearson.com/en/support/support-topics/results-certification/grade-boundaries.html

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