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Examiners' Report
June 2022

GCSE Combined Science 1SC0 2BF

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Introduction

The Pearson Edexcel GCSE (9-1) Paper 4 Combined Science (Foundation tier) is the fourth of six papers taken as part of the GCSE (9-1) Combined Science qualification. Candidates must complete all six papers in the same year of certification. Paper 4 contains questions assessing the content of topic 1 and topics 6 to 9 as identified in the specification. The paper total is 60 marks and is assessed by a variety of question types; these include multiple-choice questions, short answer questions, calculations and one extended open-response question worth six marks. 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. Candidates should answer all questions in a time period of 1 hour and 10 minutes. 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 mandatory core practical tasks in topics 1, 6, 8 and 9. Candidates must complete these core practicals prior to the written assessments, as aspects of working scientifically are also assessed in questions throughout the paper.

In this examination series, candidates were required to respond to questions that tested their knowledge and understanding of the carbon cycle, the water cycle, the composition of human blood, osmosis, photosynthesis, transport in plants, transpiration and blood vessels. The extended open-response question was based on the structure and function of the heart.

Questions designed to assess practical skills included preparing a microscope slide of onion cells, describing how to improve the quality of a set of results and describing how to change an investigation to find the effect of a different variable. The assessment of maths skills included calculating the diameter of an image seen using a microscope, calculating the rate of water uptake by plants and calculating the volume of blood flowing to muscles during exercise. Candidates of all abilities were able to access the more straightforward microscopy calculation, but the other two calculations generally proved to be more challenging.

Questions where marks could be gained by interpreting given information were answered well. Even when candidates scored low or no marks, there was evidence from a reasonable number of an attempt to use the diagrams, graphs and information in the stem of the question to try to guide their responses.

Question 1 (a)(i)

This question was about the carbon cycle. Candidates were asked to name the process that transfers carbon from plants to animals.

This was not an easy introduction to the paper for many candidates and a large proportion did not score the mark.

1 (a) Figure 1 shows part of the carbon cycle.

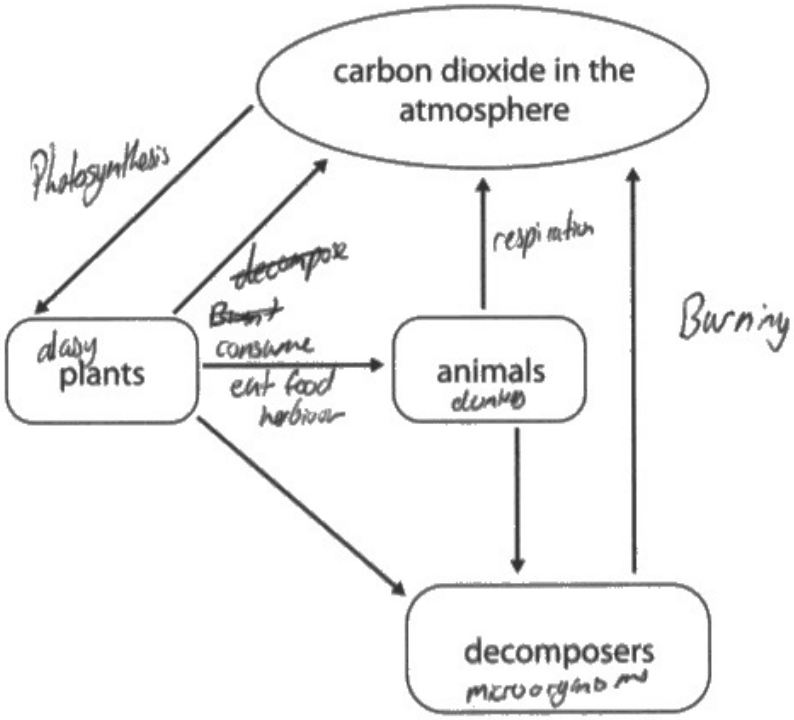


Figure 1

(i) Name the process that transfers carbon from plants to animals.

(1)

consumerism

ResultsPlus
Examiner Comments

This is not a creditworthy answer. The candidate has used their knowledge of the carbon cycle to label the diagram. Apart from burning, the labels are correct.

Eating or feeding or consuming would be acceptable answers for one mark, but not consumerism as the candidate has written.

ResultsPlus
Examiner Tip

Annotating or labelling diagrams to organise your thoughts is good practice.

Question 1 (a)(ii)

This was a sentence completion question about the carbon cycle.

Approximately half of all candidates could select both missing words to complete the sentences correctly.

Question 1 (c)(i)

This question was about making river water suitable for drinking. Approximately half of all candidates could give a correct reason why water is filtered.

Common responses included to remove sediment and to remove bacteria, both of which scored the mark.

Question 1 (c)(ii)

This question was about making river water suitable for drinking.

The majority of candidates could give a correct reason for treating water with chemicals.

Most of the creditworthy responses stated to destroy or kill bacteria.

(ii) Give **one** reason why water is treated with chemicals.

(1)

to make it taste better

ResultsPlus
Examiner Comments

This answer scores one mark. To make the water taste better is an acceptable answer to the question.

ResultsPlus
Examiner Tip

Always check that you have given a reason in your answer. Just writing a word such as bacteria or taste would not score a mark.

Question 2 (a)(i)

This was a matching pairs question. A significant number of candidates did not follow the instruction about drawing straight lines and instead, drew two or more lines from each part of the blood to different functions.

It was surprising to find that a large proportion of candidates could not correctly link at least one part of the blood to its function.

2 (a) Blood contains red blood cells, white blood cells, plasma and platelets.

(i) Draw **one** straight line from each part of the blood to its function.

(2)

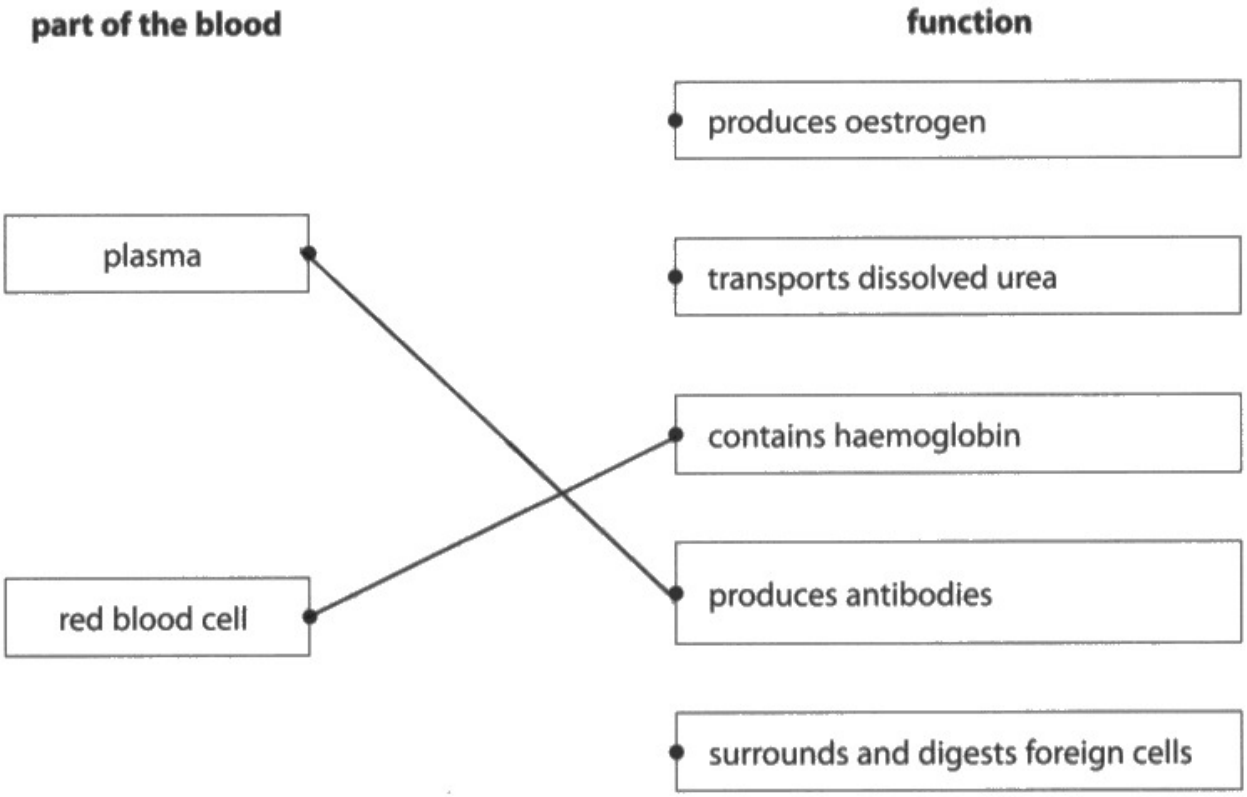
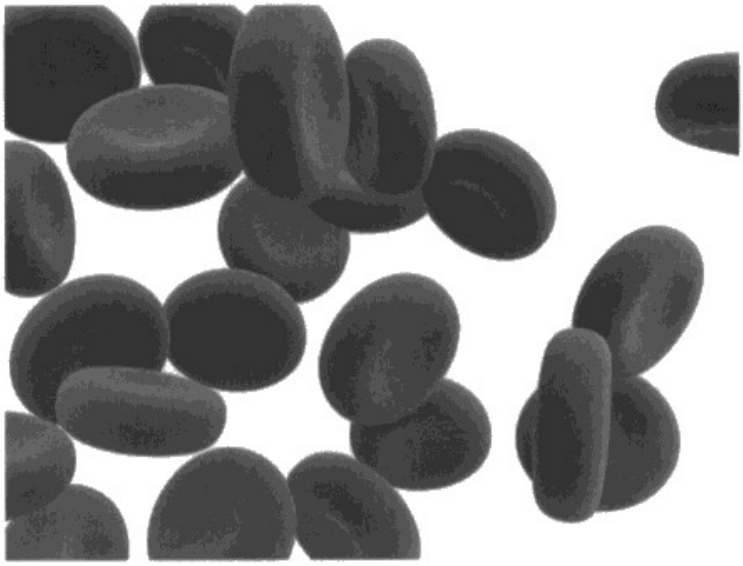


Figure 2 shows some red blood cells.



(Source: © SciePro/Shutterstock)

Figure 2

ResultsPlus
Examiner Comments

This response is worth one mark.

The candidate has followed the instruction to draw **one** straight line from each part of the blood and they have correctly linked red blood cell to its function (contains haemoglobin).

Plasma is not linked to the correct function.

2 (a) Blood contains red blood cells, white blood cells, plasma and platelets.

(i) Draw **one** straight line from each part of the blood to its function.

(2)

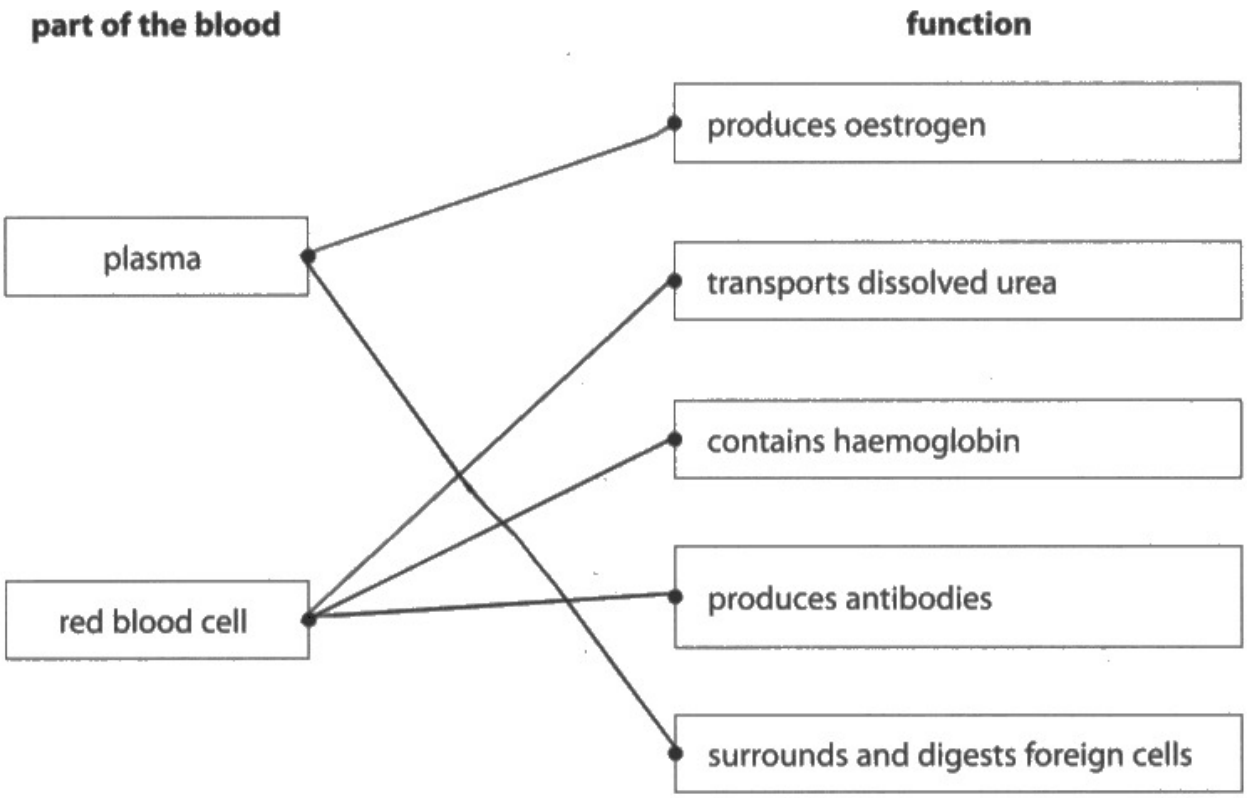


Figure 2 shows some red blood cells.

(Source: © SciePro/Shutterstock)

Figure 2

ResultsPlus
Examiner Comments

This is not a creditworthy response. The candidate has not followed the instruction to draw **one** straight line from each part of the blood to its function.

ResultsPlus
Examiner Tip

Always read the question carefully and follow the instructions given.

Question 2 (a)(ii)

In this question, candidates were given a photograph of red blood cells and were asked to state two features that can be seen.

In general, candidates showed some knowledge of red blood cell structure, but many also explained the advantage of the structure, which was unnecessary.

(ii) State **two** features that can be seen in the red blood cells in Figure 2.

(2)

1 The blood cells have a biconcave shape.

2 The red blood cells ~~are~~ have a round shape.

ResultsPlus
Examiner Comments

This answers scores two marks. Two features of red blood cells have been correctly identified.

ResultsPlus
Examiner Tip

Always try to make your answers clear and concise.

(ii) State **two** features that can be seen in the red blood cells in Figure 2.

(2)

1 They have a dent in them for larger surface area to carry more oxygen

2 They are circular which is better for movement in the plasma

ResultsPlus
Examiner Comments

This answer is worth two marks.

Having dents and a large surface area are the same marking point.

Circular is an acceptable alternative to round.

ResultsPlus
Examiner Tip

Always check what the question is asking you to do. There is no need to give explanations for the features in this question.

Question 2 (b)(ii)

This question tested maths skill and was also linked to a practical procedure. Candidates were required to calculate the diameter of an image of a lymphocyte.

A large proportion of candidates scored both marks. Many candidates showed good practice by recalling and writing down the correct equation to use.

A small lymphocyte has a diameter of 10 µm (micrometres).

A microscope magnifies this lymphocyte 400 times.

(ii) Calculate the diameter of the image of the lymphocyte seen using this microscope.

(2)

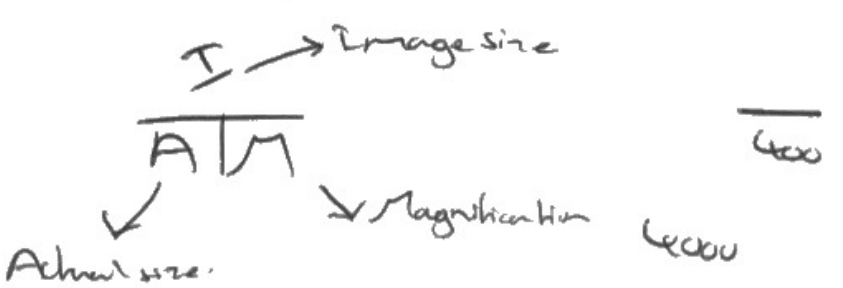


image size 4000 µm

ResultsPlus Examiner Comments

The correct answer on the answer line scores two marks.

This candidate has made a note of how to complete microscopy calculations in a triangle format. No working has been shown, although it appears that the candidate has tried multiplication and division.

ResultsPlus Examiner Tip

Always show your working, even if you are confident about your answer.

A small lymphocyte has a diameter of 10 µm (micrometres).

A microscope magnifies this lymphocyte 400 times.

(ii) Calculate the diameter of the image of the lymphocyte seen using this microscope.

(2)

m ÷ a

400 ÷ 10 = 40

image size 40 µm

ResultsPlus
Examiner Comments

This is not a creditworthy answer.

The candidate has been able to recall the 'triangle' to help them with the calculation. Unfortunately they have divided magnification by the actual size of the lymphocyte instead of multiplying these numbers.

ResultsPlus
Examiner Tip

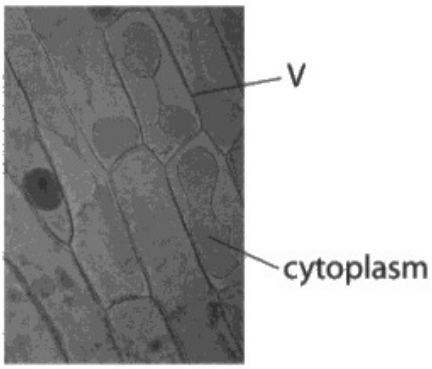
Writing down triangles is a useful way of remembering how to complete calculations, but always learn what the symbols mean and learn how to use the triangle.

Question 3 (a)(i)

This question asked candidates to give a reason why some onion cells had been stained. Straightforward responses such as to make the cells more visible were expected.

Many candidates did not read the question carefully enough and responded that the salt solution caused the cells to be stained.

3 (a) Figure 3 shows some onion cells that have been soaked in a concentrated salt solution.



(Source: © Rattiya Thongdumhyu/Shutterstock)

Figure 3

(i) The cells in Figure 3 have been stained.

Give **one** reason why the cells have been stained.

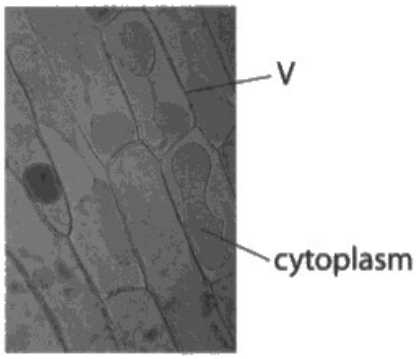
(1)

In order to make the cells ~~vis~~ more visible

ResultsPlus
Examiner Comments

This response scores the mark for 'to make the cells more visible'. To make the nucleus more visible or to see organelles were also acceptable answers.

3 (a) Figure 3 shows some onion cells that have been soaked in a concentrated salt solution.



(Source: © Rattiya Thongdumhyu/Shutterstock)

Figure 3

(i) The cells in Figure 3 have been stained.

Give **one** reason why the cells have been stained. (1)

and sub-cellular structures

So you can see the structure more clearly.

ResultsPlus
Examiner Comments

To see the sub-cellular structures is enough for the mark here. A response such as 'to see structures more clearly' would also be creditworthy.

ResultsPlus
Examiner Tip

Always think about your answer before you write anything down, particularly if there is only one answer line. Try to avoid writing above or below answer lines.

Question 3 (a)(iii)

This question was about the movement of water out of cells by osmosis. Candidates were told that some onion cells had been soaked in a concentrated salt solution and that this solution has a higher concentration than the solution inside the cell.

The question asked candidates to explain why the cytoplasm shrinks from the sides of the cell when the cells are in the concentrated salt solution.

A straightforward answer, such as the cells lose water, would score one mark, whereas cells lose water by osmosis would score two marks.

In general, this question caused issues for many candidates. Most candidates attempted to answer it, but their understanding of osmosis tended to let them down. In many cases, candidates referred to a reaction between salt and the cytoplasm being the cause of the cytoplasm shrinking.

(iii) The salt solution outside the cell has a higher concentration than the solution inside the cell.

Explain why the cytoplasm shrinks away from the sides of the cell when the cells are in salt solution.

(2)

water flows out of the cell & into the surrounding fluid due to osmosis.

ResultsPlus
Examiner Comments

This concise answer scores two marks. The candidate has stated what happens (water moves out of the cells) and why this happens (by osmosis). 'Surrounding fluid' can be accepted for salt solution.

(iii) The salt solution outside the cell has a higher concentration than the solution inside the cell.

Explain why the cytoplasm shrinks away from the sides of the cell when the cells are in salt solution.

(2)

Because the salt solution outside the cell has a higher concentration than the solution inside the cell

ResultsPlus
Examiner Comments

This is not a creditworthy response. The candidate has simply restated the stem of the question.

ResultsPlus
Examiner Tip

Remember that simply repeating the stem of the question will not gain you any marks.

(iii) The salt solution outside the cell has a higher concentration than the solution inside the cell.

Explain why the cytoplasm shrinks away from the sides of the cell when the cells are in salt solution.

(2)

The swater inside the cytoplasm is moving out of the cell via osmosis, so the water is moving from a haigh concentration to a low concentration.

ResultsPlus
Examiner Comments

This is a clear, concise response scoring two marks. The candidate seems to have a good understanding of osmosis because they have gone on to give a partial definition of the process.

Question 3 (b)

This question required candidates to describe how to prepare a microscope slide of onion cells.

The question was very accessible, with a large proportion of candidates scoring high marks. Although unlabelled, the diagrams undoubtedly helped many candidates to visualise the procedure they were asked to describe.

(b) Figure 4 shows the equipment used to prepare a microscope slide of onion cells.

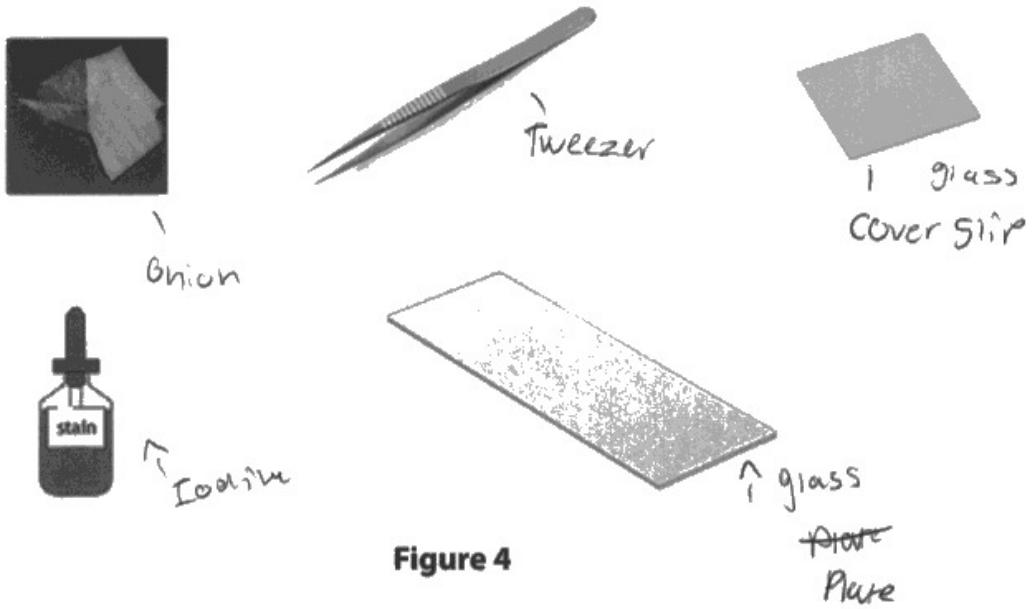


Figure 4

Describe how this equipment could be used to prepare a slide of onion cells to view under a microscope.

(3)

The tweezers should be used to pull a thin layer of onion cell off and place it on the glass plate. The stain is iodine which should be put(one drop) on to the onion to emphasise the cells. You should then put the glass cover slip on to flatten the onion and push the stain all around the onion cell.

ResultsPlus
Examiner Comments

The candidate has labelled the diagrams to help with their description of how to prepare a microscope slide of onion cells. The answer is very well-structured and scores the full three marks.

ResultsPlus
Examiner Tip

Labelling or annotating diagrams is a useful way of organising your ideas.

(b) Figure 4 shows the equipment used to prepare a microscope slide of onion cells.

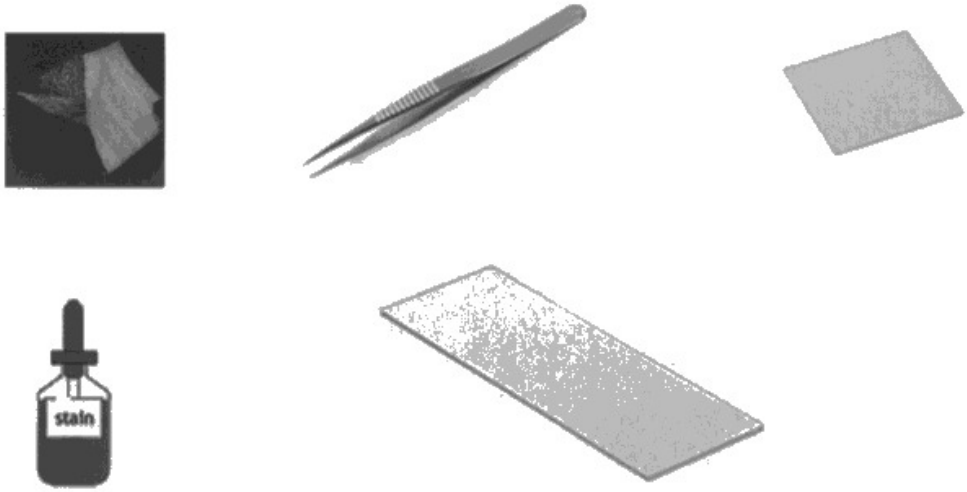


Figure 4

Describe how this equipment could be used to prepare a slide of onion cells to view under a microscope.

(3)

first, the slide must be placed and held by the clips on the stage, then the onion cells are to then be placed using the tweezers on the ~~Big~~ larger slide, ~~then~~ a drop of stain is to be added and then the smaller slide ~~should be~~ is placed ontop of the cell, using tweezers the smaller slide should be ~~tapped~~ to release any air bubbles.

ResultsPlus
Examiner Comments

This candidate has started their procedure by clipping the microscope slide to the stage of the microscope. This point does not detract from the rest of the answer, which gives good detail of the procedure. The important thing to note is that the procedure is logical and workable.

Question 3 (c)

This question asked candidates to state two conclusions from data presented in a graph. It proved to be a very challenging question for the majority of candidates, who were generally confused by the scale on the y axis.

Only a small proportion of candidates correctly identified the concentration of sucrose solution that resulted in no change in mass of the potato cylinders (0.33 mol/dm^3). Some candidates understood how the mass of the potato cylinders changed either side of this point.

Overall, this was a low scoring question.

(c) A student investigated the percentage change in mass of potato cylinders placed in sucrose solutions of different concentrations.

Figure 5 shows the results of the student's investigation.

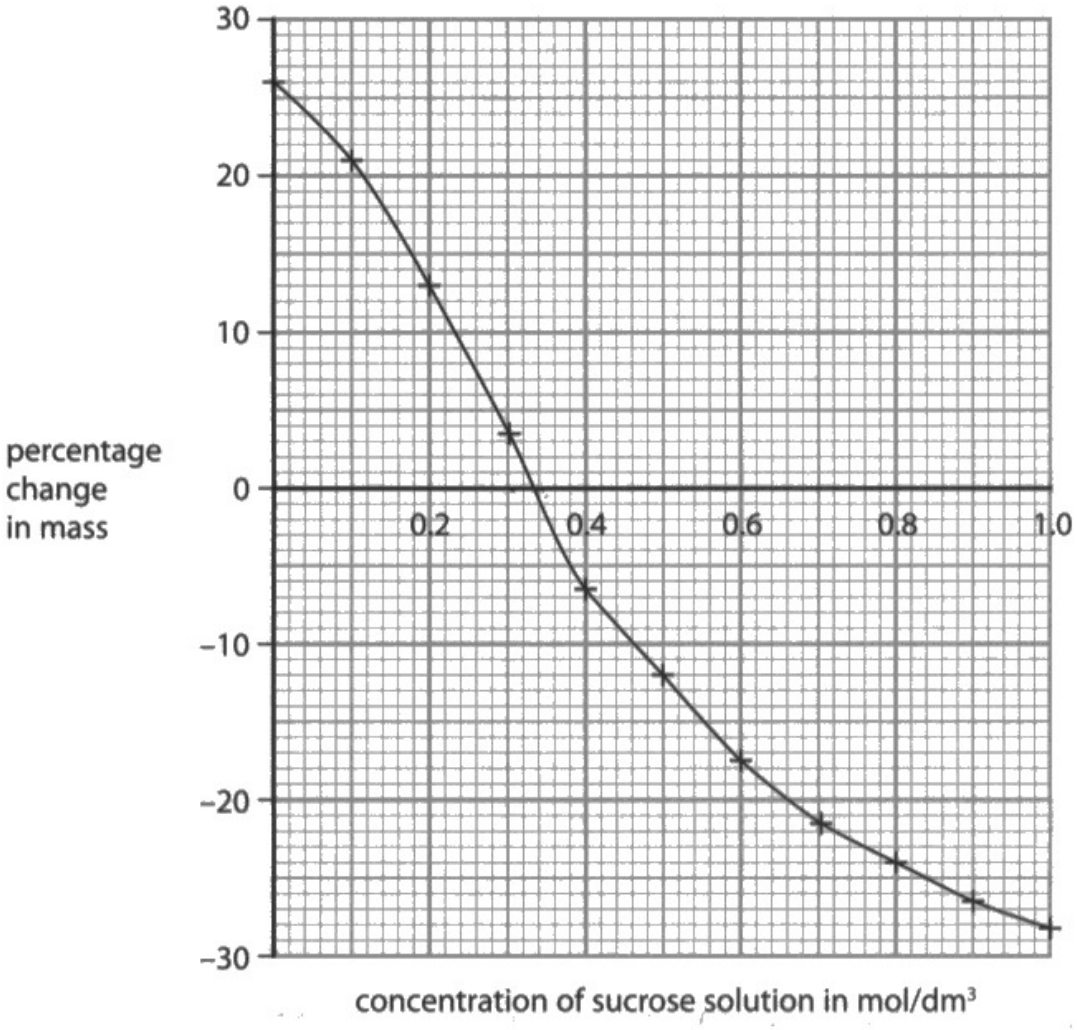


Figure 5

State **two** conclusions that can be made from these results.

(2)

1 there is no percentage change when 0.34 mol/dm³ of sucrose

2 percentage change decreases when the concentration increases

ResultsPlus
Examiner Comments

This answer scored one mark for determining the concentration of sucrose solution that resulted in no overall change in mass of the potato cylinders; 0.33 mol/dm^3 and 0.34 mol/dm^3 were acceptable.

The second conclusion is similar to that written by many other candidates. The negative values on the y axis have not been taken into account and the conclusion is incorrect. It was not uncommon to see the reverse of this point too.

ResultsPlus
Examiner Tip

Try to analyse graphs in sections and describe or state conclusions relevant to each section. For example, one section of this graph could be considered to be 0 to 0.33 mol/dm^3.

(c) A student investigated the percentage change in mass of potato cylinders placed in sucrose solutions of different concentrations.

Figure 5 shows the results of the student's investigation.

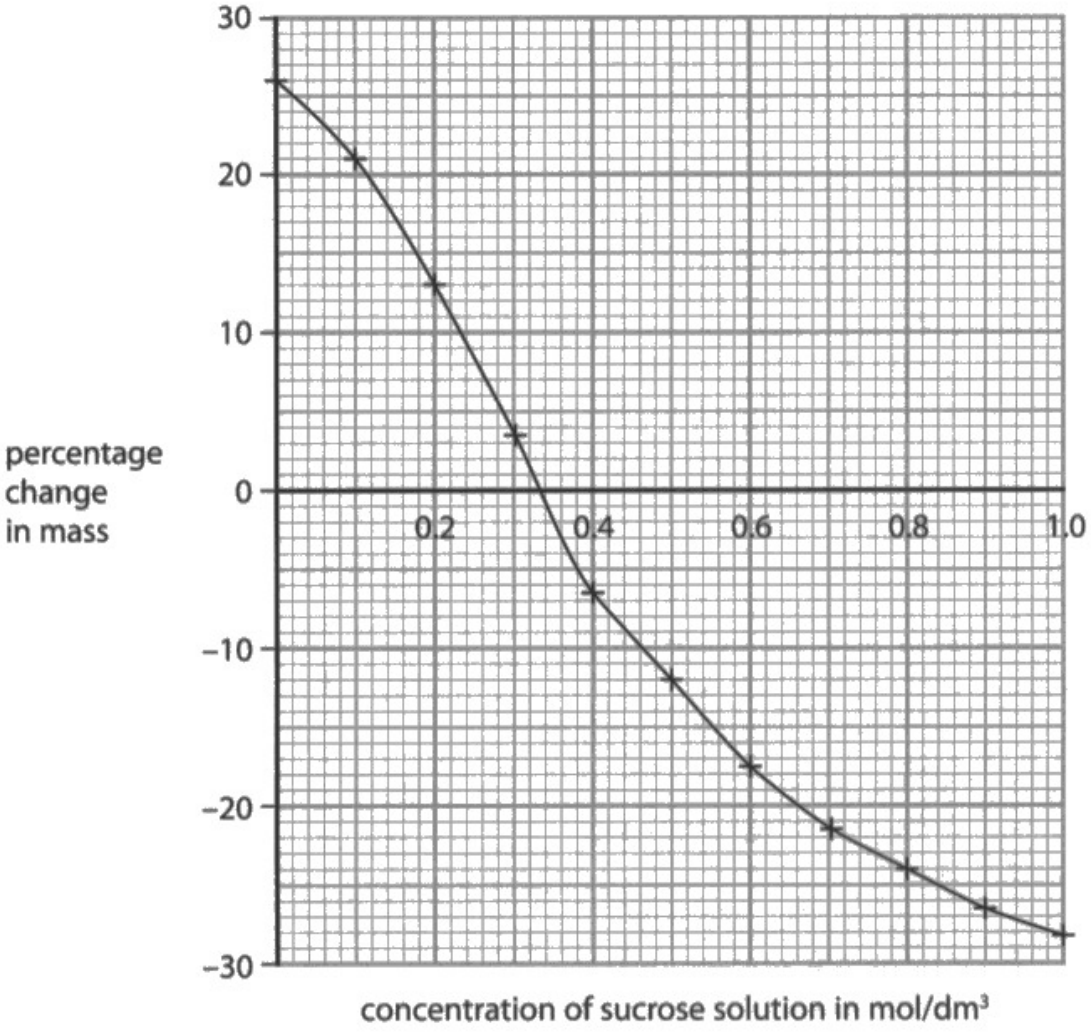


Figure 5

State **two** conclusions that can be made from these results.

(2)

1 The more sucrose solution there is the higher percentage change in mass

2 Lower percentage chang in mass the more concentration of sucrose solution there is

ResultsPlus
Examiner Comments

This answer does not score any marks. In the first conclusion, the candidate has incorrectly referred to the quantity of sucrose solution instead of concentration.

In the second conclusion, the candidate has not interpreted the graph correctly.

(c) A student investigated the percentage change in mass of potato cylinders placed in sucrose solutions of different concentrations.

Figure 5 shows the results of the student's investigation.

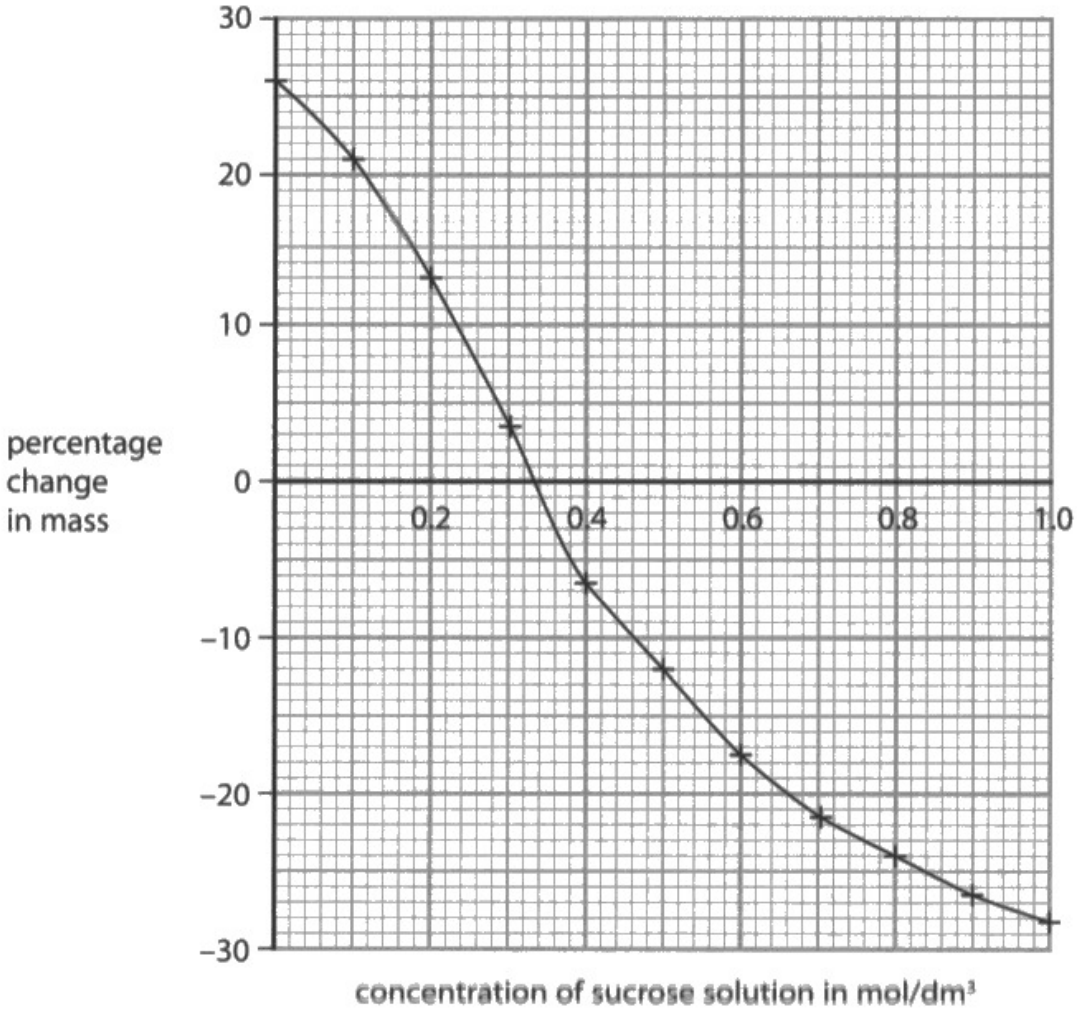


Figure 5

State **two** conclusions that can be made from these results.

(2)

1 Ass the concentration solution goes up, the percentage change in mass decreases.

2 when the concentration solution was at it's highest the percentage was at it's lowest

ResultsPlus
Examiner Comments

This answer is not creditworthy but is very typical of many responses seen. In general, candidates did not appreciate that for sucrose solution concentrations below 0.33 mol/dm^3, lower concentrations produced greater percentage changes in mass and that for concentrations above 0.33 mol/dm^3, higher concentrations produced greater percentage changes in mass.

Question 4 (a)(ii)

This question was based on the topic 1 core practical about the effect of light intensity on the rate of photosynthesis.

Candidates were given data to interpret, which the vast majority were able do, thus scoring one mark. However, only a tiny minority of candidates used the information in their answer as the question asked.

(ii) The rate of photosynthesis can be measured by counting the number of bubbles of gas produced in one minute.

Figure 7 shows some results from this investigation in different light intensities.

Light intensity was changed by moving the lamp towards or away from the water plant.

light intensity in arbitrary units	rate of photosynthesis in bubbles per minute
25	19
31	43
39	46
50	95
69	125
100	222

Figure 7

Describe the effect of light intensity on the rate of photosynthesis.
Use information from Figure 7 to help you.

(2)

The higher the ~~more~~ light intensity the higher the rate of photosynthesis. The anomaly is the 3 increase in ~~be~~ the rate of photosynthesis when the light intensity goes from 31 - 39.

ResultsPlus
Examiner Comments

This answer scores two marks. The candidate has described the effect of light intensity on the rate of photosynthesis.

They have gone on to analyse the data and have recognised what could be an anomaly – the increase of just three bubbles per minute when light intensity increases from 31 to 39 arbitrary units. This demonstrates the use of information and thus allows the second mark to be awarded.

ResultsPlus
Examiner Tip

To score full marks, always do what the question asks. In this case, make sure that the information in the question is used and not just quoted.

(ii) The rate of photosynthesis can be measured by counting the number of bubbles of gas produced in one minute.

Figure 7 shows some results from this investigation in different light intensities.

Light intensity was changed by moving the lamp towards or away from the water plant.

light intensity in arbitrary units	rate of photosynthesis in bubbles per minute
25	19
31	43
39	46
50	95
69	125
100	222

Figure 7

Describe the effect of light intensity on the rate of photosynthesis.
Use information from Figure 7 to help you.

(2)

As light intensity increases the rate of photosynthesis also increases. For example a light intensity of 25 only produces 19 bubbles, whereas at a light intensity of 100 the production of bubble increases by 203 to reach 222 bubbles

ResultsPlus
Examiner Comments

This answer scores both marks. The relationship between the variables has been described correctly and the information given in the question has been used. In this case, the candidate has calculated the increase in the number of bubbles per minute, which is sufficient for the second mark.

Question 4 (a)(iii)

This question asked candidates to describe how the quality of the results from a rate of photosynthesis investigation could be improved. It was surprising to find that a large proportion of candidates struggled to write creditworthy answers.

Common responses that scored one mark included video the investigation or repeat the investigation. Many candidates also scored the second mark in these pairs: play the video back to count the bubbles or calculate a mean.

Candidates need to be prepared to answer questions with a practical basis such as this.

(iii) The bubbles are different sizes and can be difficult to count.

Describe how the quality of the results from this investigation could be improved.

(2)

record the bubbles with a camera so it can be rewatched and time can be taken to count all the bubbles.

ResultsPlus
Examiner Comments

This answer is worth two marks.

The candidate has described that the bubbles can be recorded with a camera and the recording can be played back to count the bubbles.

(iii) The bubbles are different sizes and can be difficult to count.

Describe how the quality of the results from this investigation could be improved.

(2)

Them results can be improved by repeating the investigation several times, or by getting more people to count the amount of bubbles produced.

ResultsPlus
Examiner Comments

This answer scores one mark for stating that the investigation should be repeated. Getting more people to count the bubbles was an acceptable alternative to this point.

(iii) The bubbles are different sizes and can be difficult to count.

Describe how the quality of the results from this investigation could be improved.

(2)

by using a gas syringe to increase the accuracy of the test

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Examiner Comments

Using a gas syringe scores one mark. In the context of the question, increasing accuracy is not a reason for using a gas syringe. However, had the candidate gone on to state that the volume of gas could be measured, then the second mark could have been given.

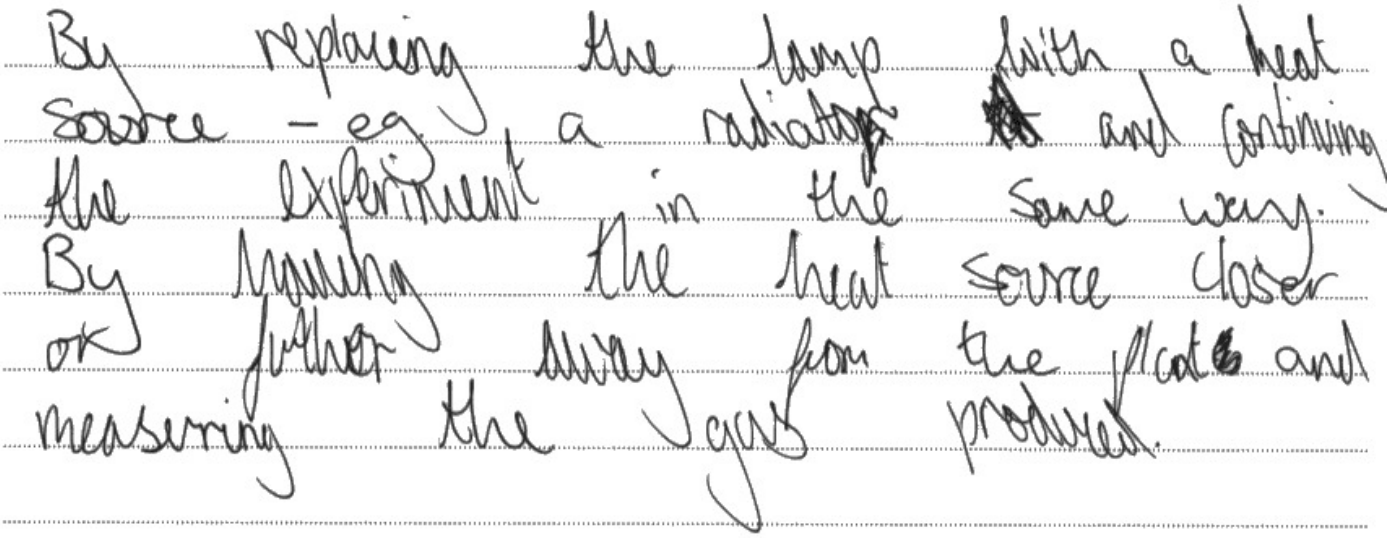
Question 4 (a)(iv)

Many candidates struggle with questions that ask them to devise a plan. In this particular case, candidates had to describe how an investigation could be changed to find the effect of temperature on the rate of photosynthesis. Details of the original investigation were given in the stem of the question, but this did not appear to provide sufficient support for a large number of candidates.

However, the need for a source of heat instead of a lamp was described fairly frequently and references to using water baths and monitoring temperature with a thermometer were not uncommon. It was disappointing that few candidates described the need to control other variables such as light intensity.

(iv) Describe how this investigation could be changed to find the effect of temperature on the rate of photosynthesis.

(3)



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Examiner Comments

This answer scores one mark. The candidate has suggested using a heat source instead of a lamp. Moving the heat source closer or further away from the plant was an acceptable way of changing temperature, so this scores the mark. On its own, just measuring the gas is insufficient for further credit.

(iv) Describe how this investigation could be changed to find the effect of temperature on the rate of photosynthesis.

(3)

light intensity will be equal all throughout the experiment instead different temperatures of water (boiling) can be varied to see what is more efficient to increase the process of photosynthesis. You could be going up in 10° for a not so precise effect.

ResultsPlus
Examiner Comments

This answer is worth two marks. The candidate has scored one mark for describing the need to control light intensity and another mark for varying the temperature of the water.

ResultsPlus
Examiner Tip

Check the number of marks available and make sure you include enough points in your answer to gain all those on offer. Here, you could include the use of a thermometer to monitor temperature or count the number of bubbles per minute at each different temperature.

Question 4 (b)

This question was about the effect of eutrophication on fish living in a lake. As a topic, eutrophication either tends be understood reasonably well, or not understood at all. Few candidates could give clear, structured explanations that outlined what happens when excess nitrates enter lakes, but the majority recognised that the end result would be the death of the fish.

(b) Increased nitrates can cause eutrophication in lakes.

Explain how eutrophication will affect the fish living in the lakes.

(3)

Eutrophication can lead to algae build up on the top of the lake. This would lead to a lack of sunlight reaching the lake floor, therefor preventing photosynthesis from lake plants. Consequently, a lack of photosynthesis results in fish dying due to the lower levels of oxygen being produced in the lake as plants will release oxygen into the lake during photosynthesis.

ResultsPlus
Examiner Comments

This is a good answer that scores three marks. The candidate has written clearly and with a good understanding of eutrophication and its effects.

(b) Increased nitrates can cause eutrophication in lakes.

Explain how eutrophication will affect the fish living in the lakes.

(3)

Eutrophication can cover the surface of the lake stopping light from reaching the water plants. They can not ~~photosynthesi~~ photosynthesise, so oxygen will not be produced. The fish can then suffocate.

ResultsPlus
Examiner Comments

This answer is worth two marks. The candidate is confused by what will cover the surface of the lake, but light being blocked from water plants scores a mark; the consequent lack of photosynthesis and oxygen production scores a second mark. Fish suffocating was not credited as an appropriate alternative to the death of fish.

Question 5 (a)(i)

This question asked candidates to identify a part of a plant root hair cell.

It was disappointing to find that less than a half of all candidates did not have the relevant knowledge of plant cell structure to do this correctly.

Question 5 (a)(ii)

This question required candidates to explain one adaptation of a plant root hair cell. A clear diagram of a root hair cell was given in the stem of the question.

Many candidates scored one mark for stating that root hair cells have a large surface area, but relatively few explained that this would increase the rate of absorption of water and mineral ions.

(ii) Explain **one** adaptation of a root hair cell that increases the absorption of water and mineral ions.

(2)

It has a large surface area so it can absorb lots of water and mineral ions.

ResultsPlus
Examiner Comments

This answer scores one mark for stating that root hair cells have a large surface area. Absorbing lots of water and minerals is insufficient as an explanation, there needs to be a clear indication that the **rate** of absorption will increase.

ResultsPlus
Examiner Tip

In questions that use the command word 'explain', always check that you have given an explanation of a particular situation.

(ii) Explain **one** adaptation of a root hair cell that increases the absorption of water and mineral ions.

(2)

it has a long part and the hair takes up more surface area to absorb the water and mineral ions

ResultsPlus
Examiner Comments

In this answer the candidate has recognised that root hairs cells are long and that this gives them a large surface area. Therefore, two marks can be awarded.

Question 5 (b)(ii)

This question asked candidates to describe two features of xylem vessels that can be seen in a diagram.

Instead of describing structural features such as thick walls and continuous tubes, many candidates described the direction of flow in these vessels.

It was pleasing to note that some candidates had very good knowledge of xylem structure and stated that they are dead, or that they are lignified.

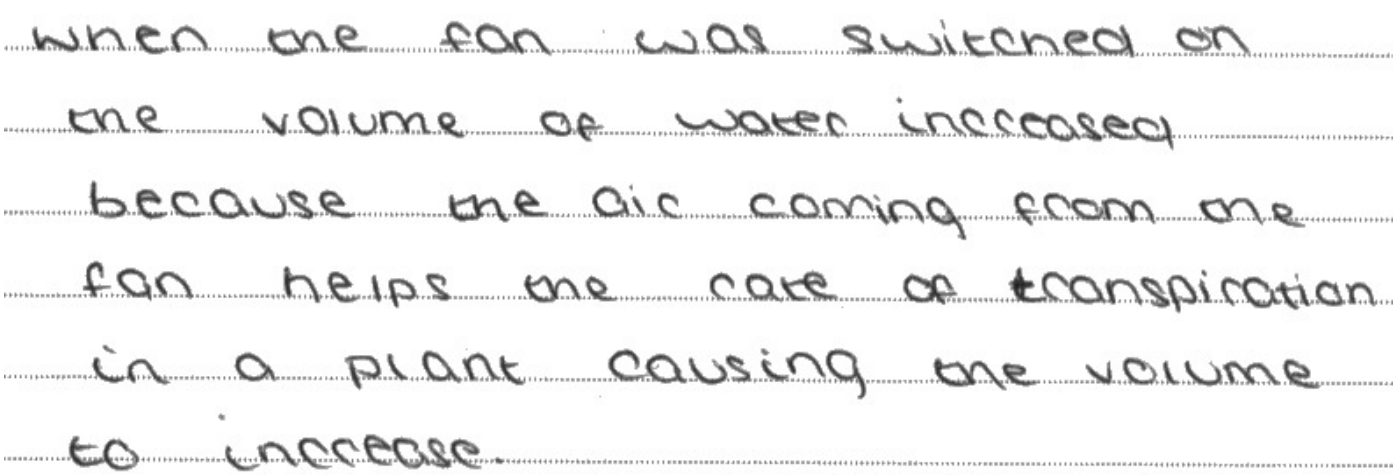
Question 5 (c)(i)

This question was about the effect of air flow on the rate of transpiration. Most candidates showed some understanding of transpiration and many scored a mark for stating that the volume of water taken up by the plant would increase, but correct explanations of why this happened were usually limited in their scope.

Only a minority of candidates appreciated that moving air from the fan would remove water from around the leaf, thus increasing the rate of transpiration, but such responses were rare.

(i) Explain why switching on the fan caused a change in the volume of water taken up by the plant.

(3)



ResultsPlus
Examiner Comments

This answer is worth two marks. The candidate understands that the volume of water taken up will increase and that this is because the fan causes air to move. However, the reference to the rate of transpiration is not specific; there needs to be a clear indication that the rate of transpiration will increase.

ResultsPlus
Examiner Tip

Remember that 'explain' means additional scientific information needs to be linked to the answer given.

(i) Explain why switching on the fan caused a change in the volume of water taken up by the plant.

(3)

When the fan is switched on the flow of air changes as it increases and more air is flowing so the water taken up by the plant increases. The faster the flow of air the more the rate of transpiration and it increases.

ResultsPlus
Examiner Comments

This is a good, concise answer worth three marks. The candidate has linked an increased flow of air to an increase in the rate of transpiration and therefore an increase in water uptake.

ResultsPlus
Examiner Tip

When you revise transpiration, check that you can explain how different factors affect the rate of transpiration.

Question 5 (c)(ii)

This question was about how the flow of air from a fan affects transpiration rate. Candidates were asked to give one reason why the volume of water taken up by the plant was also measured when the fan was not switched on.

It was pleasing to see that a large proportion of candidates gave creditworthy answers, but there were very few specific references to this being a control.

Question 5 (c)(iii)

This question assessed the ability of candidates to extract information from a graph to perform a rate calculation.

Many candidates found this task difficult and a surprising number failed to use the graph at all.

(iii) Calculate the rate of water uptake from 8 minutes to 10 minutes when the fan was switched on.

Use the equation

$$\text{rate of water uptake} = \frac{\text{volume of water taken up}}{\text{time taken}}$$

(2)

$\frac{68}{10} \cdot \frac{52}{8} \quad \frac{59}{9} = \quad \frac{16}{2}$

$68 - 52$

8 mm³ per minute

ResultsPlus Examiner Comments

This answer is worth two marks. The correct answer is written on the answer line, but in addition to this, the candidate's working is clear and readings from the graph have been recorded. The reading at 9 minutes can be ignored.

ResultsPlus Examiner Tip

Always show your working in calculation questions.

(iii) Calculate the rate of water uptake from 8 minutes to 10 minutes when the fan was switched on.

Use the equation

$$\text{rate of water uptake} = \frac{\text{volume of water taken up}}{\text{time taken}}$$

(2)

8 ÷ 10
= 0.8

0.8 mm³ per minute

ResultsPlus
Examiner Comments

This is not a creditworthy response. The candidate has not taken relevant readings from the graph at 8 minutes and 10 minutes.

(iii) Calculate the rate of water uptake from 8 minutes to 10 minutes when the fan was switched on.

Use the equation

$$\text{rate of water uptake} = \frac{\text{volume of water taken up}}{\text{time taken}}$$

(2)

8 – 10

= 2 minutes

51 – 68

= 17 mm^3

$\frac{17}{2} = 8.5$

8.5 ..... mm^3 per minute

ResultsPlus
Examiner Comments

This answer is worth one mark.

The reading taken from the graph at 8 minutes is incorrect. However, the subsequent calculation – dividing the difference in the values by two – scores one mark.

ResultsPlus
Examiner Tip

Always check the scales on the axes of graphs and make sure that you take accurate readings.

(iii) Calculate the rate of water uptake from 8 minutes to 10 minutes when the fan was switched on.

Use the equation

$$\text{rate of water uptake} = \frac{\text{volume of water taken up}}{\text{time taken}}$$

8 9 10
52 59 68
=6·5 6·5 6·8

(2)

6·5.

..... mm³ per minute

ResultsPlus
Examiner Comments

This response scores one mark.

Correct readings have been taken from the graph at 8 minutes and 10 minutes. However, the candidate has not calculated the difference between these readings, nor divided this answer by two.

Question 6 (a)(i)

This question required candidates to explain one difference between the artery wall and the vein wall, as shown in the cross-section in the stem of the question.

The majority of candidates scored one mark for making a correct, comparative statement, but relatively few scored the second marking point by referring to higher blood pressure in arteries.

6 (a) Figure 11 shows a cross-section of an artery and a vein.

(Source: © The University of Kansas Medical Center)

Figure 11

(i) Explain **one** difference between the artery wall and the vein wall shown in Figure 11.

(2)

The artery wall is much thicker. This is is because the blood will be at a high pressure when passing through the artery, so the artery is adapted to that

ResultsPlus
Examiner Comments

This response scores two marks. The candidate has given a clear explanation of one difference between the artery wall and the vein wall.

ResultsPlus
Examiner Tip

This answer is clear and links key ideas together using relevant scientific terminology. The candidate has made sure not to repeat the stem of the question.

6 (a) Figure 11 shows a cross-section of an artery and a vein.

(Source: © The University of Kansas Medical Center)

Figure 11

(i) Explain **one** difference between the artery wall and the vein wall shown in Figure 11.

(2)

The artery wall is thicker as the blood is under high pressure. Whereas the vein wall is thinner because the blood is under low pressure

ResultsPlus
Examiner Comments

This answer is worth two marks. There is a detailed comparison of the two blood vessel walls and the explanation for it is correct.

ResultsPlus
Examiner Tip

If the question asks you to describe or explain a difference between structures, always make sure that you make comparisons, such as thicker or thinner.

In this question, just stating that the artery wall is thick would not gain credit.

Question 6 (a)(ii)

Candidates were asked to name one structure found in veins but not found in arteries.

The expected response of valves was only given by a small minority of candidates.

It is possible that candidates were looking for visual clues in the image provided in the stem of the question, rather than being expected to draw on their wider knowledge of vein structure.

Question 6 (b)(i)

This question examined the maths skill of using percentages. Candidates were required to use the data provided to calculate the volume of blood travelling to muscles during exercise. In general, responses showed that candidates could either complete the calculation correctly, or not at all.

The fact that blood volume is given in cubic decimetres confused some candidates, with many calculating 5^3 (= 125), then finding 60% of that.

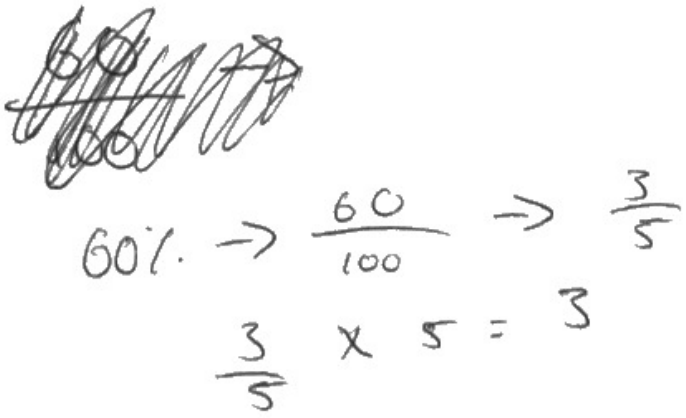
(b) A human body has 5 dm^3 of blood.

At rest 20% of the blood travels to the muscles.

During exercise 60% of the blood travels to the muscles.

(i) Calculate the volume of blood travelling to the muscles during exercise.

(2)



ResultsPlus
Examiner Comments

This answer scores two marks. The candidate has used one method of calculating 60% of 5 dm^3.

(b) A human body has 5 dm^3 of blood.

At rest 20% of the blood travels to the muscles.

During exercise 60% of the blood travels to the muscles.

(i) Calculate the volume of blood travelling to the muscles during exercise.

(2)

100%

60% + 20%
= 80%

9.5 × 8
=

60%

~~80%~~ 08 5dm^3

10% = 0.5

0.5 × 6
= 3

3 ..... dm^3

ResultsPlus
Examiner Comments

This answer is worth two marks. The candidate has used a method of using percentages they are familiar with, to arrive at the correct answer.

ResultsPlus
Examiner Tip

Always show your working in calculation questions. If your final answer is incorrect, examiners will look at your working and may give some credit for the step(s) shown.

(b) A human body has 5 dm^3 of blood.

At rest 20% of the blood travels to the muscles.

During exercise 60% of the blood travels to the muscles.

(i) Calculate the volume of blood travelling to the muscles during exercise.

(2)

$5^3 = 125$

$20\% = 24$

$40\% = 48$

$60\% = 96$

96 dm^3

ResultsPlus
Examiner Comments

This response does not gain any credit.

The candidate has found the value of 5^3. They have then gone on to calculate 60% of this figure.

ResultsPlus
Examiner Tip

The cubic decimetre (dm^3) is a unit of volume. It is not necessary to cube the numbers given in the question.

(b) A human body has 5 dm^3 of blood.

At rest 20% of the blood travels to the muscles.

During exercise 60% of the blood travels to the muscles.

(i) Calculate the volume of blood travelling to the muscles during exercise.

(2)

5 dm^3 = Blood
20% = travels to muscules
60% = travels during exersid

60% ÷ 5 dm^3 = 12

÷

12 ..... dm^3

ResultsPlus
Examiner Comments

This is not a creditworthy response. The method used to calculate 60% of 5 dm^3 is incorrect.

ResultsPlus
Examiner Tip

As well as learning scientific facts, always revise the maths skills the specification expects you to be familiar with.

Question 6 (b)(ii)

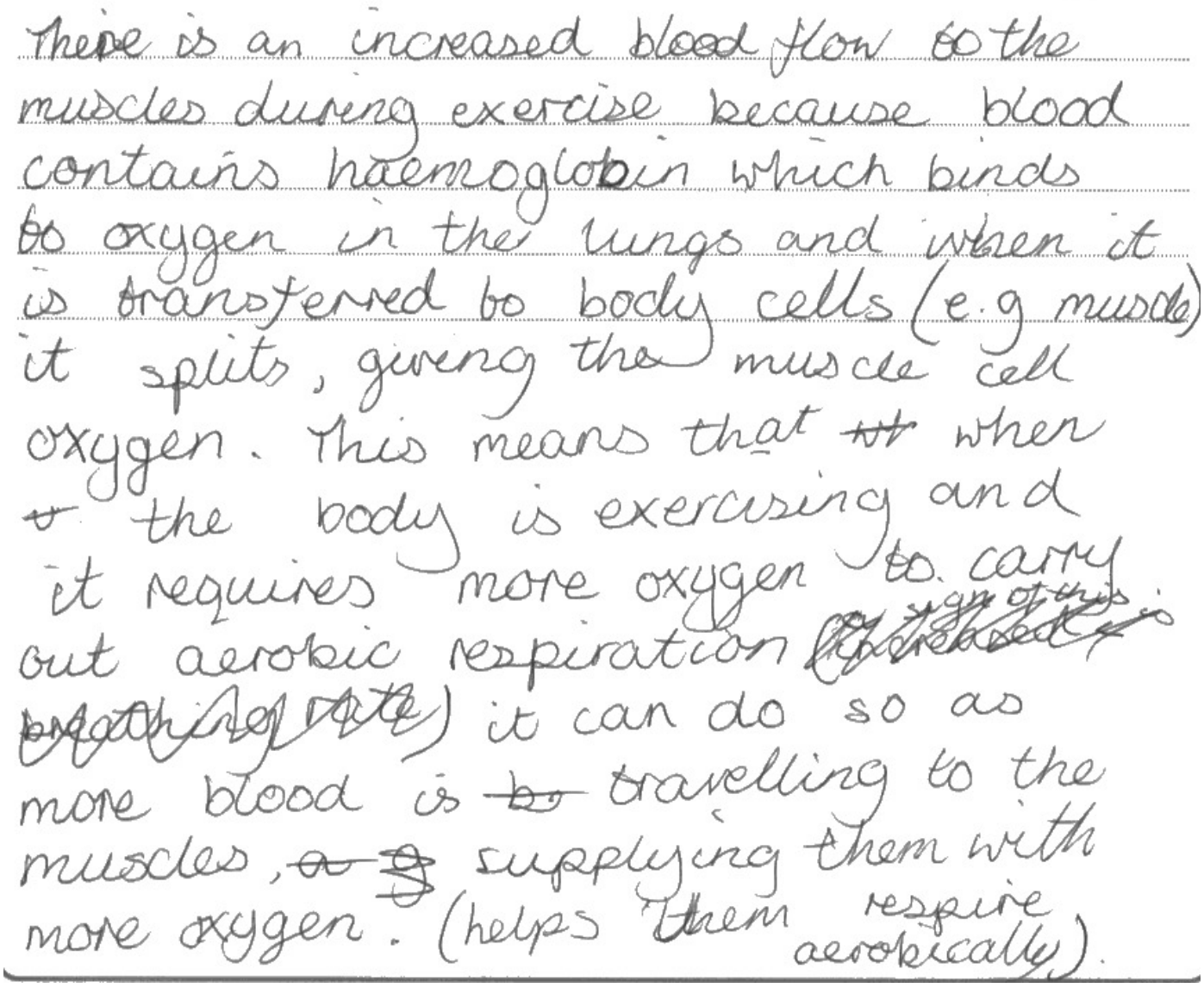
This question caused many candidates a great deal of difficulty; they were required to explain one reason why there is an increased flow of blood to muscles during exercise.

Many candidates could state that muscles use oxygen (and glucose), but relatively few linked this to the fact that during exercise, the demand for oxygen (and glucose) by muscles is greater. Only a very small proportion of candidates produced a good explanation, by stating that additional oxygen or glucose is needed for respiration.

Only a tiny minority of candidates wrote about an increase in blood flow to muscles to remove more carbon dioxide or lactic acid from them.

(ii) Explain **one** reason why there is an increase in blood flow to muscles during exercise.

(2)



ResultsPlus
Examiner Comments

This response is worth two marks. The answer begins by repeating the question and includes some unnecessary information about haemoglobin. The creditworthy points (more oxygen required for respiration) have been repeated twice and the candidate has extended their answer well below the answer lines.

ResultsPlus
Examiner Tip

Always think about what information is relevant to the question and how you will structure an answer, before writing anything down.

There is no need to repeat the question in your answer and try to avoid writing above or below answer lines.

If you think that you need extra space, ask for an additional answer sheet.

(ii) Explain **one** reason why there is an increase in blood flow to muscles during exercise.

(2)

More oxygen needs to be present for aerobic respiration, so more ~~blo~~ oxygen-carrying ~~blood~~ red blood cells are pumped to the muscles ~~cells~~.

ResultsPlus
Examiner Comments

This is a succinct answer that scores two marks.

(ii) Explain **one** reason why there is an increase in blood flow to muscles during exercise.

(2)

There is an increase in blooflow during excercise as the muscles are contracting during exceptise and receiving energy during respiration so they need an increase in blood flow

ResultsPlus
Examiner Comments

This answer is worth one mark. Although the candidate has not made a link between increased blood flow and an increase in the supply of oxygen to muscles, the correct reference to respiration scores a mark.

(ii) Explain **one** reason why there is an increase in blood flow to muscles during exercise.

(2)

- to break down the lactic acid build up

ResultsPlus
Examiner Comments

This answer does not score a mark. However, a reference to an increase in blood flow to remove lactic acid would be creditworthy.

Question 6 (c)

This extended open-response question asked candidates to explain how the structure of the heart is related to its function. At the most basic level, candidates could gain a mark in level 1 for stating that the heart pumps blood. However, many candidates showed good knowledge and understanding of the heart and sometimes wrote at length about blood flow and relevant structures and functions. Many candidates demonstrated good practice by annotating the diagram and this often helped them to organise their responses.

Not all responses were well-organised though and the names of chambers, blood vessels and the flow of blood were often confused.

*(c) Figure 12 shows the structure of the human heart.

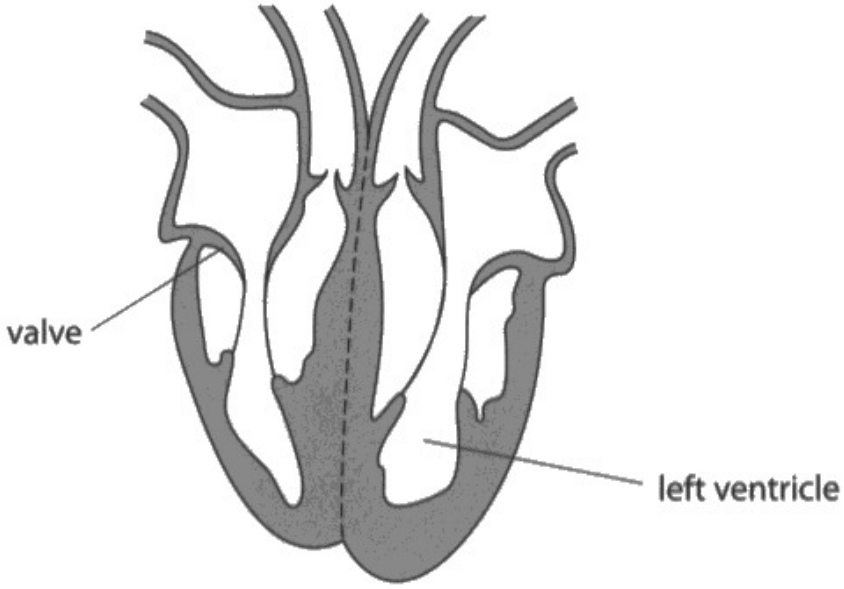


Figure 12

Explain how the structure of the heart is related to its function.

(6)

Makes you stay alive pumps blood around your ~~blood~~ body

ResultsPlus
Examiner Comments

This is a simple level 1 response. The candidate has given a basic function of the heart – to pump blood – but there is no detail of structures, such as muscular walls.

*(c) Figure 12 shows the structure of the human heart.

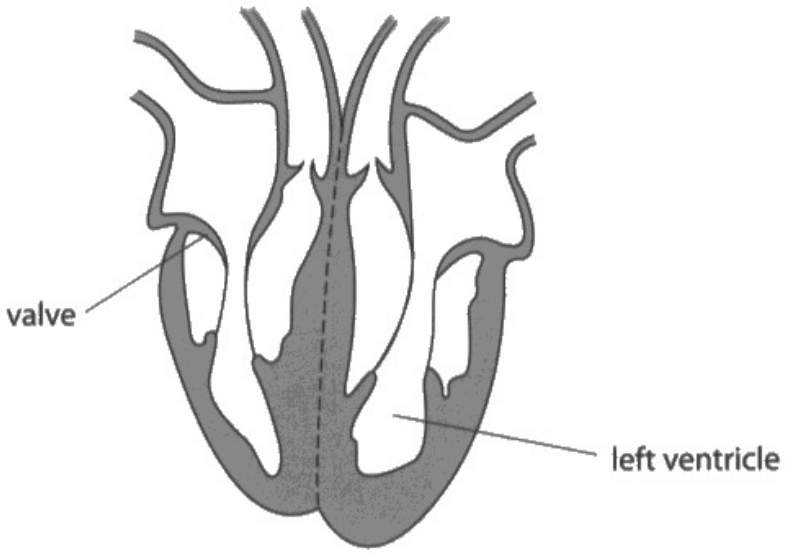


Figure 12

Explain how the structure of the heart is related to its function.

(6)

In a human heart we have a left ventricle right ventricle, left atrium and right atrium which help hold blood and oxygenated blood. We have aorter and vena cava. Also Pulmonary vein and pulmonary artery which travel oxygen to heart and away. In the heart we also have valves which help prevent back flow of blood. So when blood is going up the body valves are there to keep the blood moving.

ResultsPlus
Examiner Comments

This is a good level 1 answer. The candidate has described various structures associated with the heart. However, the only creditworthy section of the response is about valves preventing the backflow of blood – a structure and its function have been linked.

ResultsPlus
Examiner Tip

Always check that you have linked a structure and a function to ensure you gain credit for what you know and understand. Just giving a list of structures is unlikely to gain any marks.

*(c) Figure 12 shows the structure of the human heart.

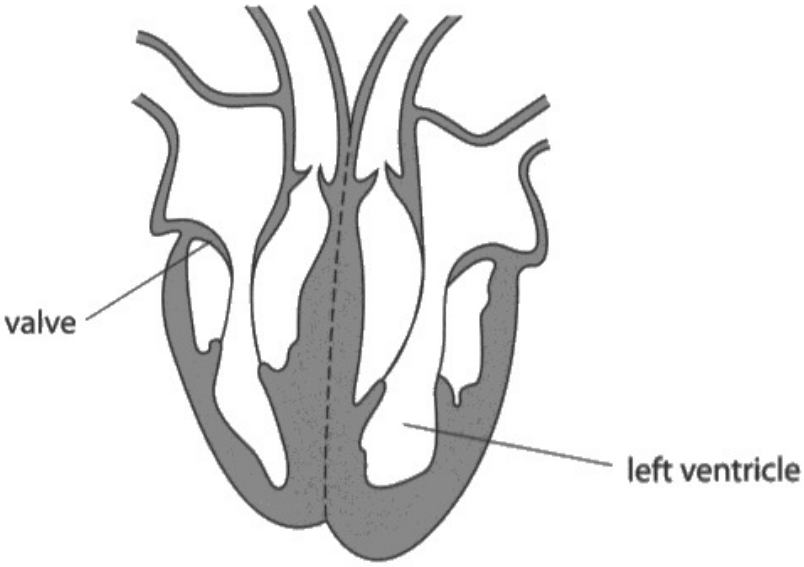


Figure 12

Explain how the structure of the heart is related to its function.

(6)

the structure of the heart is related to its funtions because when the blood is being pumped around the body the valves open and close to stop the back flow and pressure on the heart creating a safe mechnical body ~~p~~organ to ~~get~~ get the arteries to push blood to the feet and to the brain.

ResultsPlus
Examiner Comments

This a level 2 response. The candidate has made a simple comment about the heart pumping blood. They have gone on to link valves with preventing the backflow of blood. The extra detail about the heart pumping blood is just enough to put this answer into level 2.

*(c) Figure 12 shows the structure of the human heart.

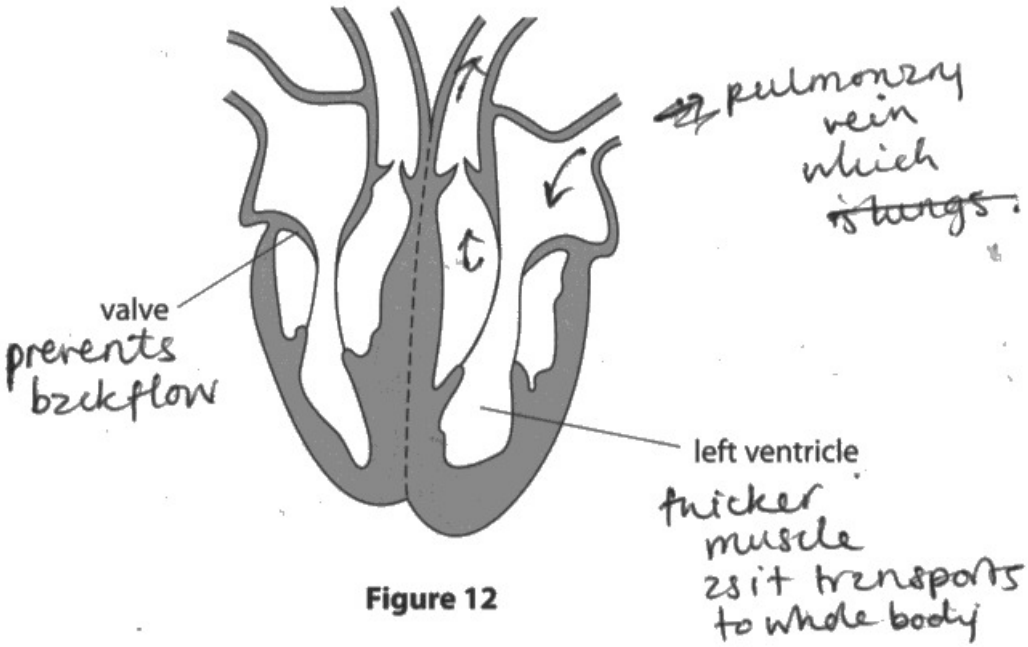


Figure 12

Explain how the structure of the heart is related to its function.

(6)

The heart has four chambers, left ventricle, left atrium, right ventricle and right atrium, these four chambers allow blood to pass through the heart. The right side has deoxygenated blood flowing through it which then goes ~~back up to~~ the lungs through the vena cava, comes back down to the pulmonary vein, which is now oxygenated blood. The left ventricle has a bigger muscle because the oxygenated blood is pumped around the whole body through the aorta, meaning the left has to be a stronger muscle. The function of the heart is to pump blood through the body, the valves prevent backflow which stops blood going the wrong way, ~~each~~ the ~~structure of the heart allows the heart to pump blood quickly to~~ the whole body.

(Total for Question 6 = 13 marks)

TOTAL FOR PAPER = 60 MARKS

ResultsPlus
Examiner Comments

This is a detailed level 3 answer. The candidate has written some useful annotations on the diagram of the heart, which shows good practice and includes some creditworthy points.

The introductory sentence does not add value to the overall answer and has resulted in the candidate writing below the answer lines.

However, several structures and functions are linked, putting this answer at the top of level 3.

ResultsPlus
Examiner Tip

Annotating a diagram is good practice if it helps you to structure your answer. Remember that there is no need to write an introduction to extended open-response questions; just try to answer the question as concisely as possible.

Try to avoid writing below the answer lines. Ask for an additional answer sheet if you need more space to write in.

*(c) Figure 12 shows the structure of the human heart.

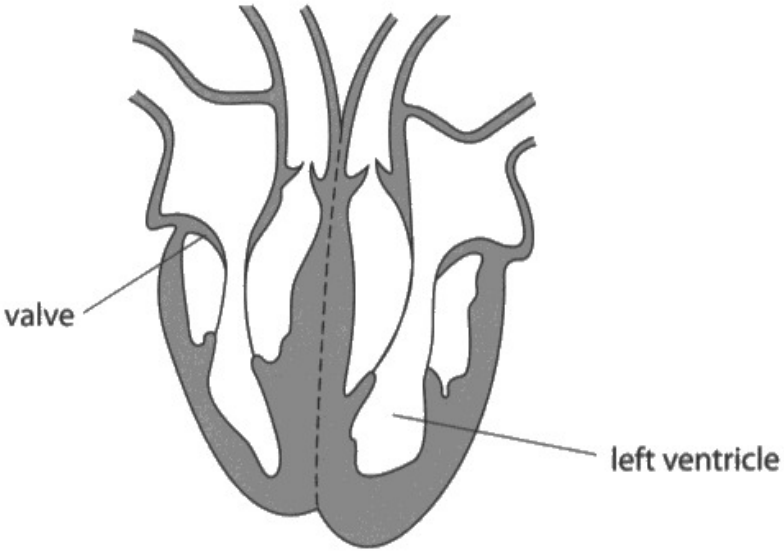


Figure 12

Explain how the structure of the heart is related to its function.

(6)

De oxygenated blood flows through the vena cava into the right atrium. The blood then goes through the right ventricle up to the pulmonary artery which takes it to the lungs to get oxygen. Oxygenated blood flows back through the pulmonary vein. It then goes into the left atrium and into the left ventricle. Then it goes through the left ventricle up to the aorta to where it is then carried to the rest of the body. Valves in both ventricles prevent blood flowing backwards.

ResultsPlus
Examiner Comments

This is a good level 3 response.

The answer is concise, giving details of the flow of blood through the heart, but also links structures and their functions.

Paper Summary

Many candidates demonstrated a good level of knowledge in the early questions. Throughout the paper, they showed they could extract and use data from graphs and tables. Most candidates were able to access the extended open-response question, demonstrating some knowledge and understanding of the structure and function of the heart.

In general, the application of knowledge of core practicals was challenging for many candidates; scientific terminology also needs to be used more frequently when answering questions related to practical tasks.

Most candidates could access straightforward maths questions, such as calculating the diameter of a cell, but using percentages proved to be more difficult.

Based on their performance on this paper, candidates should:

- Recognise that the word 'explain' means additional scientific information is needed that is linked to the answer given.
- Use all the information given in the question to help them construct their answer but avoid repeating the information which has already been given or giving vague responses which will not gain credit.
- Consider the context of the question to ensure they apply their scientific knowledge to the situation they are being asked about.
- Develop their practical skills knowledge to ensure they understand the difference between the factors being investigated and controlled variables.
- Check the number of marks given for the question and ensure that they have included enough facts to match the marks available.
- Use scientific terminology accurately where possible in responses.
- Always show the working when doing calculations as a mark can be awarded for errors carried forward in this case.
- Think about the structure of the answer before starting to write, especially when tackling the extended questions, to ensure that the answer shows clarity of writing and flows, while also remembering that accurate spelling and grammar in these questions is important.

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