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Examiners' Report
June 2024

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 paper taken as part of the GCSE (9-1) Combined Science qualification. The qualification follows a linear assessment model whereby candidates must complete all papers in the same year of certification. Paper 4 Combined Science (Foundation 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 an extended open-response question. Candidates should answer all questions in 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 six mandatory core practical tasks that candidates must complete prior to the examination, as aspects of working scientifically are also assessed in questions throughout the paper.

This Combined Science paper contains questions assessing the content from Topic 1 and Topics 6 to 9 as identified in the specification. In this examination series, candidates were required to respond to questions that tested their knowledge and understanding of microscopy, photosynthesis, the endocrine system, diabetes, gas exchange, the heart and circulation, root hair cells, osmosis and water movement through plants. Questions designed to assess practical skills included drawing a bacterial cell from a photograph, planning an experiment to investigate if plants grow faster when they receive more light and interpreting heart rate data before, during and after exercise. The assessment of maths skills in this paper included calculating cardiac output and calculating the volume of red blood cells in a sample of blood.

In general, this was an accessible paper and the majority of candidates attempted to answer all questions. Questions where marks could be gained by extracting and interpreting information from graphs, were answered well. Most candidates made a good attempt at drawing and labelling a bacterial cell although some candidates thought they were drawing a sperm cell.

Relatively few candidates scored full marks on the ‘explain’ questions. This is because they did not give the extra scientific information needed to support their answers or did not differentiate between the command words 'describe' and 'explain'.

It was pleasing to note that the performance on the experimental design question was better than in previous examinations. At least one mark was scored by most candidates because they understood the question and were familiar with its principles although some candidates planned experiments using pondweed instead of using the equipment shown in the question.

Most candidates attempted to answer the extended open-response question. The accessibility of the question may have been helped by the inclusion of a diagram, but the principles of water movement through plants were generally understood. However, in some instances there was confusion between the role of xylem and the role of phloem in plants. Some candidates wrote extensively about the water cycle, rather than focusing on the context of the question. The majority of candidates accessed at least Level 1. Many candidates accessed Level 2 because they were able to write about more than part of the route taken by water through the plant / tree. Fewer candidates gained marks in Level 3 because their responses lacked the necessary additional detail about the route taken by water, such as information about xylem or stomata.

Question 1 (a)

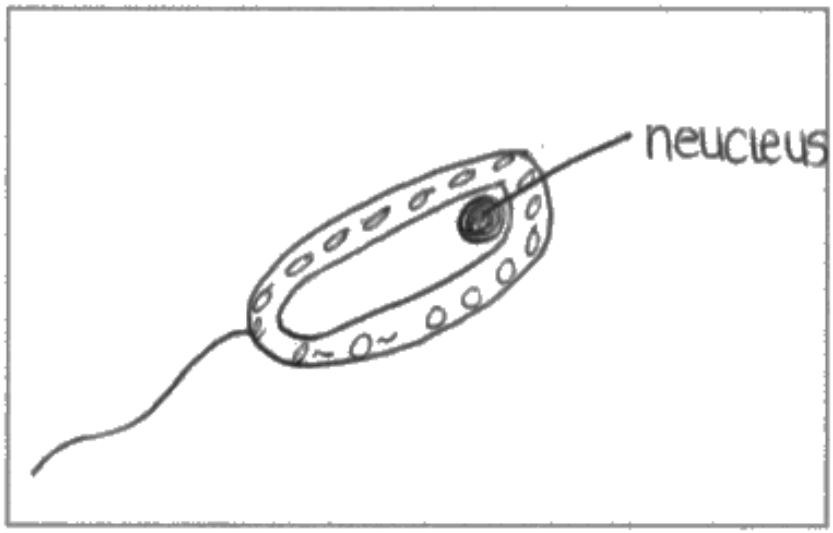
This was a familiar matching pairs question. The vast majority of candidates followed the instruction to draw one straight line from each part of the microscope to its function. However, a small minority of candidates still need guidance on how to complete these questions.

Question 1 (b)(i)

This question asked candidates to produce a biological drawing of a bacterial cell. Biological drawing questions have been set in previous examination series and improvements in skill have been seen. This question was answered well, with a large proportion of candidates scoring at least two marks. Candidates who were unfamiliar with the structure of a bacterial cell sometimes drew and labelled a nucleus or mitochondria. In some instances no flagella were drawn, even though two were clearly visible in photograph B.

(i) Draw, in the box, the bacterial cell labelled X.

Label **one** part of the bacterial cell on your diagram.



ResultsPlus
Examiner Comments

This response scores one mark for the correct shape of the bacterial cell. Bacterial cells do not have a nucleus and the candidate has only drawn one flagellum.

ResultsPlus
Examiner Tip

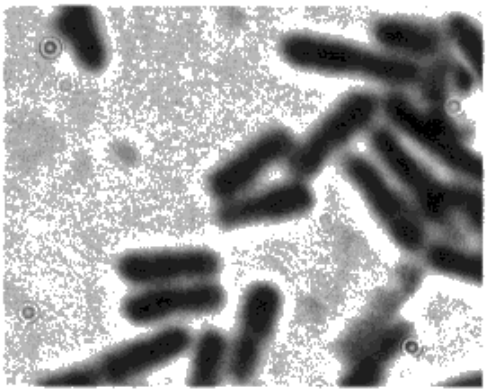
Draw what you can see in the photograph. In this case, just the outline of the cell is sufficient. Do not add details that might only be seen in other types of cell.

(b) Figure 2 shows two photographs of bacteria.

Photograph A was taken through a light microscope.

Photograph B was taken using an electron microscope.

Photograph A



Photograph B

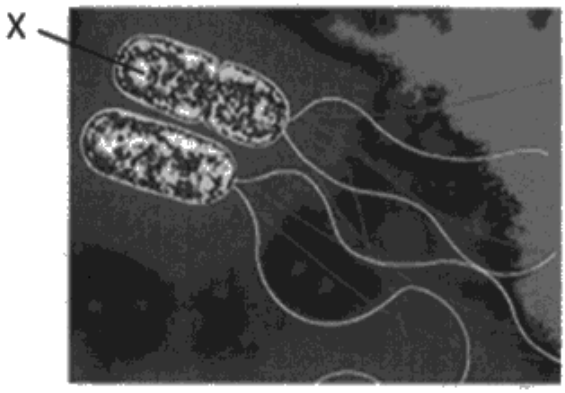
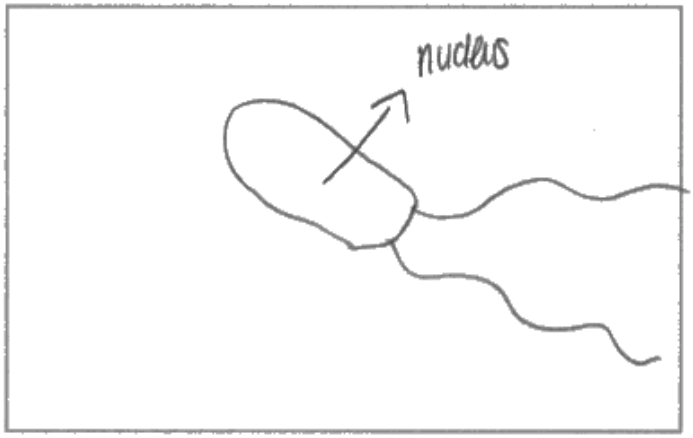


Figure 2

(i) Draw, in the box, the bacterial cell labelled X.

Label **one** part of the bacterial cell on your diagram.

(3)

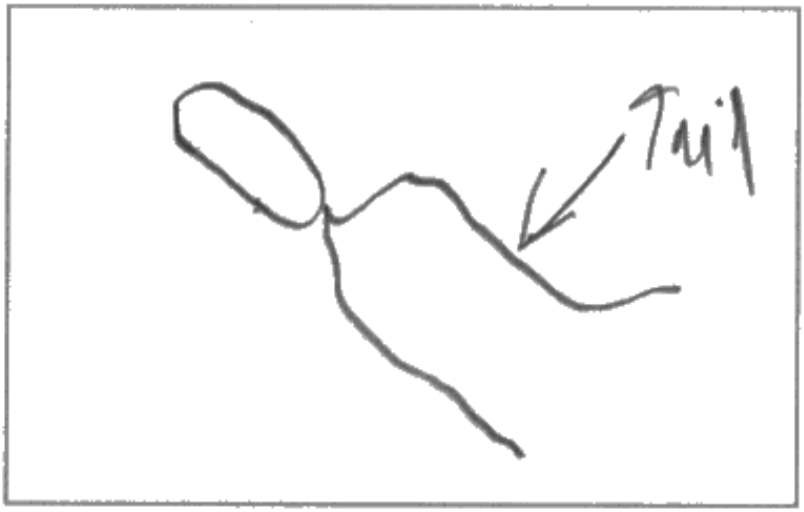


ResultsPlus
Examiner Comments

This response scores two marks for drawing the basic outline of the cell with two flagella. The nucleus label can be ignored.

(i) Draw, in the box, the bacterial cell labelled X.

Label **one** part of the bacterial cell on your diagram.

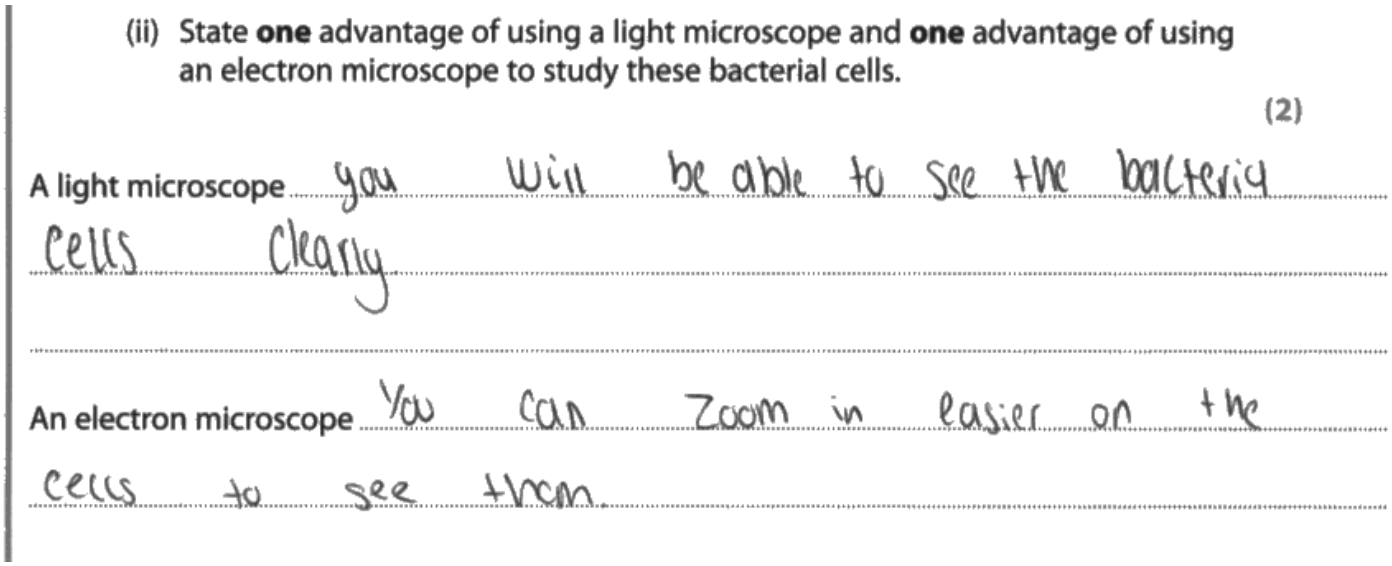


ResultsPlus
Examiner Comments

This is a simple drawing that scores all three marks. Tail is an acceptable alternative label for flagellum.

Question 1 (b)(ii)

Questions on microscopes are seen routinely on Combined Science (Biology) papers. However, Q01(b)(ii) was not well-answered. Candidates had to state one advantage of using a light microscope and one advantage of using an electron microscope. Candidates who were familiar with this area of the specification usually answered well. However, there were many references to both microscopes being able to see structures more clearly and being able to 'zoom in'. Neither point gained credit. The most common advantages of a light microscope stated were being easy to use and being portable. The most common creditworthy answer stated for an electron microscope was being able to see structures in more detail, followed by greater magnification or higher resolution.



(ii) State **one** advantage of using a light microscope and **one** advantage of using an electron microscope to study these bacterial cells.

(2)

A light microscope you will be able to see the bacteria cells clearly

An electron microscope You can zoom in easier on the cells to see them.

ResultsPlus
Examiner Comments

Neither stated advantage is creditworthy. Being able to see bacterial cells clearly and 'zoom in' are insufficient to score marks.

ResultsPlus
Examiner Tip

Check that you know the main advantages of using light microscopes and electron microscopes. Always use the correct scientific terms. Being able to see things more clearly and zooming in are not scientific.

(ii) State **one** advantage of using a light microscope and **one** advantage of using an electron microscope to study these bacterial cells.

A light microscope is cheaper to use.

An electron microscope is very expensive.

ResultsPlus
Examiner Comments

The candidate has given two converse answers. In the context of the light microscope, 'cheaper to use' is acceptable for affordable. The stated advantage of an electron microscope does not score a mark; we are looking for higher resolution or the idea of showing more detail.

(ii) State **one** advantage of using a light microscope and **one** advantage of using an electron microscope to study these bacterial cells.

(2)

A light microscope shows the ~~the~~ colour and shape of cell, bacteria and more

An electron microscope shows everything in detail ~~and~~ (is extremely clear)

ResultsPlus
Examiner Comments

This scores one mark for shows colour (light microscope) and one mark for shows everything in detail (electron microscope).

Question 2 (b)

Q02 was linked to the specification points on photosynthesis. It was very surprising that more than 50% of candidates were unable to name chlorophyll as the green chemical in plants.

Question 2 (c)(i)

In general, questions asking candidates to plan an experiment have not been answered well in previous examination series, with many candidates often not attempting to answer these questions at all. Q02(c)(i) was attempted well, with many candidates going into considerable detail and writing outside the answer space, or using the recommended method of using an additional answer sheet. A typical answer included at least one of the following points: a description of changing light intensity, leaving the plants for a period of time, measuring the length or height of the plants (at the start and again at the end). Very few candidates referred to watering the plants.

(c) (i) Plan an experiment to investigate if plants grow faster when they receive more light.
Use the equipment shown in Figure 3.

(3)

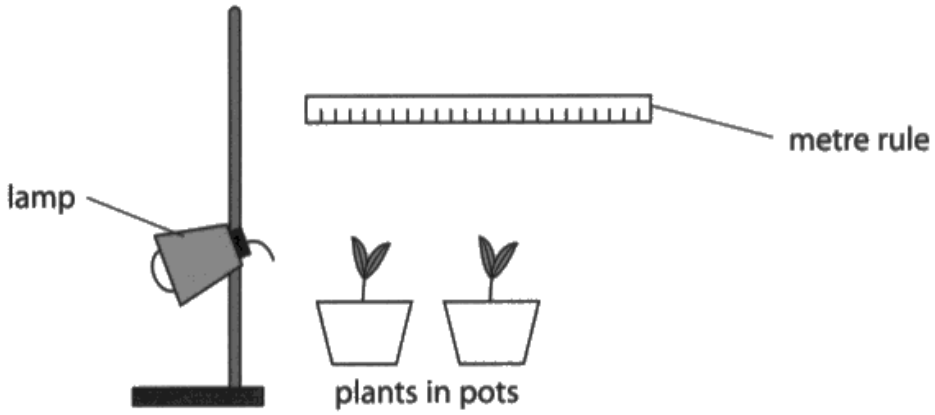


Figure 3

If you keep the lamp on the plant pots the plants will grow faster because they are always in sunlight.

ResultsPlus
Examiner Comments

Instead of planning an experiment, this candidate has described the outcome of an experiment. The response scores zero marks.

ResultsPlus
Examiner Tip

Always read the question carefully and follow the instructions given. Writing about the results of an experiment was not required in this question.

(c) (i) Plan an experiment to investigate if plants grow faster when they receive more light.
Use the equipment shown in Figure 3.

(3)

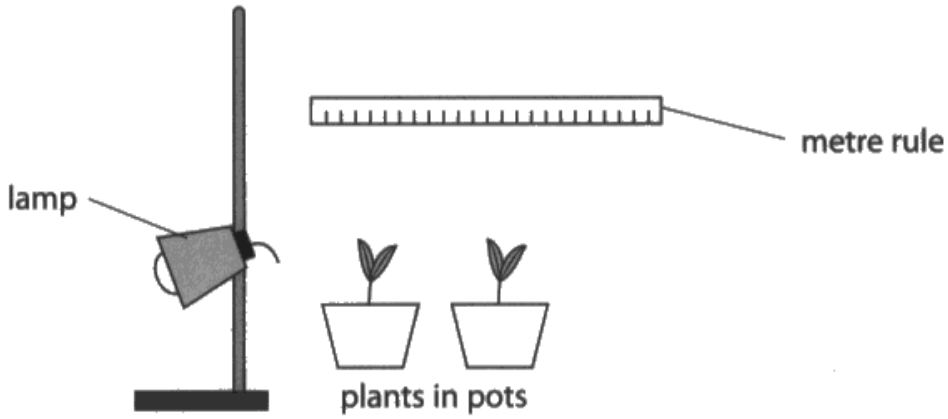


Figure 3

you have plant A under a lamp for ten days and plant B in darkness for the same time and then messure each pot plant A and B and see which is taller.

ResultsPlus
Examiner Comments

This is a clearly written response that scores full marks. The candidate has described changing the light levels for the two plants, leaving them for a period of time (10 days), then measuring how tall they are.

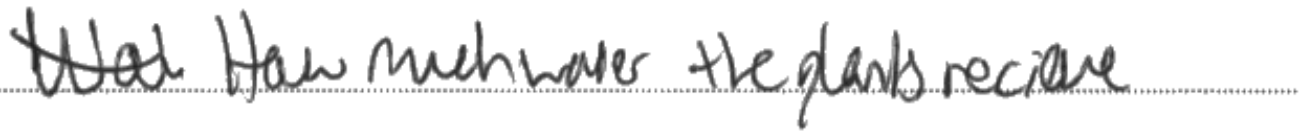
ResultsPlus
Examiner Tip

Always think about the steps of a plan before your begin to write. If you run out of answer space, ask for a continuation sheet. Try to avoid writing below or around the answer space.

Question 2 (c)(ii)

This question asked candidates to state one factor that would need to be kept the same in the photosynthesis experiment. It was disappointing that the majority of candidates were unable to do this. One of the most common mistakes was to give light intensity, the independent variable.

(ii) State **one** factor that you would keep the same in this experiment.



ResultsPlus
Examiner Comments

How much water the plants receive is insufficient to be given credit. A specific reference to the volume of water is required. The most common responses that scored marks were temperature and use the same type of plant.

ResultsPlus
Examiner Tip

Remember that if you refer to the quantity of something, always use terms such as mass and volume. In this example, the volume of water would score a mark.

(ii) State **one** factor that you would keep the same in this experiment.

(1)

~~the~~ How long you go to measure them.

~~the~~ like every 24 hours or every hour

ResultsPlus
Examiner Comments

This response scores the mark for giving a description of leaving the plants for the same time period.

Question 2 (c)(iii)

This question asked candidates to explain the effect on photosynthesis of keeping a plant at 60 ^{o}C. This was a very challenging question for the majority of candidates, with many referring to an increase in the rate of photosynthesis. A key part of the question (very high temperature) was probably missed, so linking temperature to photosynthesis and enzymes proved to be very difficult. Only a small proportion of candidates could explain that enzymes would be denatured.

(iii) A plant was kept at a very high temperature of 60 °C.

Explain the effect of this temperature on photosynthesis.

(2)

it would be too high for the plant meaning it wont work as well, the high temperature could evaporate some of the water the plant needs for nutrience leaving the plant dry and unable to photosynthesise effectively also killing some of the plants cells

ResultsPlus
Examiner Comments

This response scores two marks. 'Unable to photosynthesise' gains the first point on the mark scheme. The second mark can be awarded for two different points in the additional guidance on the mark scheme: the reference to the plant drying out or plant cells being killed.

(iii) A plant was kept at a very high temperature of 60 °C.

Explain the effect of this temperature on photosynthesis.

(2)

The hotter the plant is the slower photosynthesis will act, the enzymes are being heated too much which means the active site slows down.

ResultsPlus
Examiner Comments

This response gains one mark for referring to slower photosynthesis. The comments about enzymes are insufficient to score a second mark. Credit would have been given if the candidate had written about enzymes being denatured or the active site changing shape.

ResultsPlus
Examiner Tip

Remember that processes in living things, such as photosynthesis, are controlled by enzymes. A change in temperature will affect the rate of enzyme action. Very high temperatures cause enzymes to be denatured, so processes slow down or stop.

Question 3 (a)

Q03 was based on the specification points linked to the endocrine system and diabetes. Q03(a) asked candidates to draw two crosses to show the position of the ovaries on a diagram. Most candidates could draw the crosses in approximately the correct place on Figure 4. The mark scheme allowed a generous amount of leeway in the location of the crosses.

3 Endocrine glands produce hormones.

(a) Draw **two** crosses on Figure 4 to show the position of the ovaries.

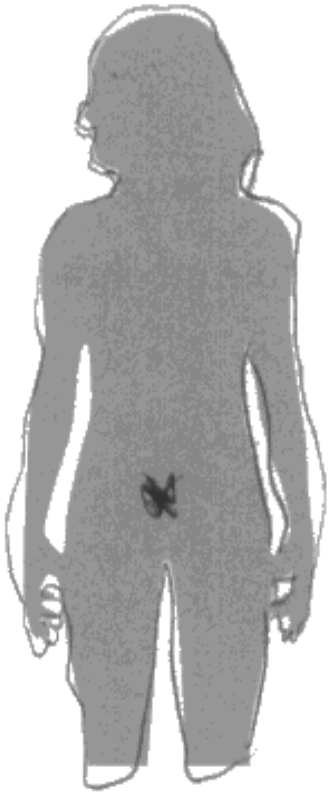


Figure 4

ResultsPlus
Examiner Comments

This response scores zero. The candidate has drawn one cross in a central position.

ResultsPlus
Examiner Tip

Always check the instructions given in the question. In this case you must draw two crosses.

3 Endocrine glands produce hormones.

(a) Draw **two** crosses on Figure 4 to show the position of the ovaries.

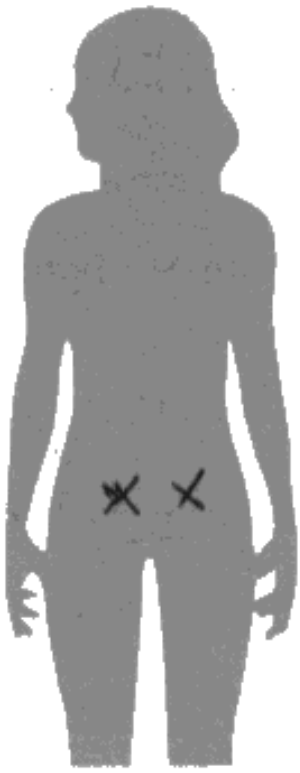


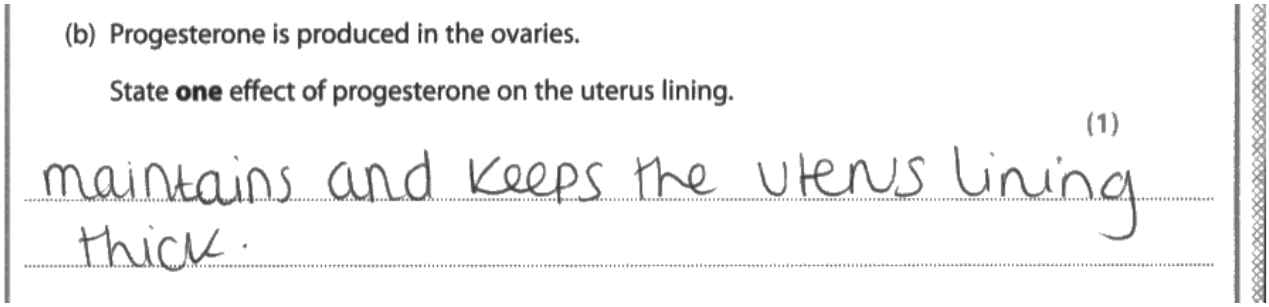
Figure 4

ResultsPlus
Examiner Comments

This response scores the mark. The location of the crosses is accurate and well within the boundaries shown on the mark scheme.

Question 3 (b)

A large proportion of candidates could not recall the effect of progesterone on the uterus lining in terms of making the lining thicker or maintaining it. Some candidates misunderstood the effect of progesterone and described the uterus lining breaking down.



(b) Progesterone is produced in the ovaries.

State **one** effect of progesterone on the uterus lining.

(1)

maintains and keeps the uterus lining thick.

ResultsPlus
Examiner Comments

This is a very clear response that scores the mark.

ResultsPlus
Examiner Tip

Check that you know the effect of the hormones given in the specification.

Question 3 (c)(ii)

The proportion of candidates who were unfamiliar with the transport of hormones in the blood was surprisingly large. Transport in blood vessels was also an acceptable answer, but not blood cells.

(ii) State how insulin is transported from its endocrine gland to its target organs.

Through the blood

ResultsPlus
Examiner Comments

'Through the blood' scores the mark. Relatively few candidates gave plasma as their answer, but references to blood vessels were more common.

ResultsPlus
Examiner Tip

Check that you know and understand the basic principles of the endocrine system, such as where particular hormones are produced, how they are transported around the body and the name of their target organ.

Question 3 (c)(iii)

It was not well known that the liver is the main target organ for insulin. Muscles was also an acceptable response. An extremely large proportion of candidates gave pancreas as their answer, with the heart and kidneys also being common responses that didn't gain credit.

Question 3 (d)(i)

This question was answered well, with the majority of candidates scoring one mark for identifying an overall decrease in blood glucose concentration between midday and 1pm. Fewer candidates scored the second mark for identifying a greater decrease between 12.30 and 1pm. Some candidates misread the question and wrote about the trend from 1pm.

(d) People with type 1 diabetes cannot produce insulin.

Figure 5 shows the blood glucose concentration for a person with type 1 diabetes.

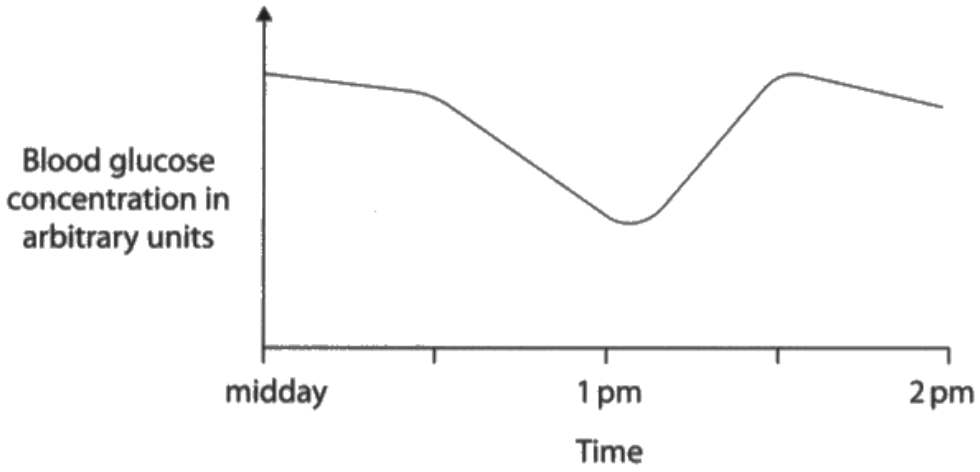


Figure 5

(i) Describe the trend from midday to 1 pm.

(2)

I don't know the glucose dropped

ResultsPlus
Examiner Comments

The glucose dropped is sufficient to score the first point on the mark scheme.

ResultsPlus
Examiner Tip

If the question asks you to describe a trend, always look at the data or graph carefully. Here there are two clear aspects to the trend – an overall decrease in blood glucose concentration and a steeper decrease between 12.30 and 1pm. Always check the number of marks available for a question so that you include an appropriate number of points in your answer.

(d) People with type 1 diabetes cannot produce insulin.

Figure 5 shows the blood glucose concentration for a person with type 1 diabetes.

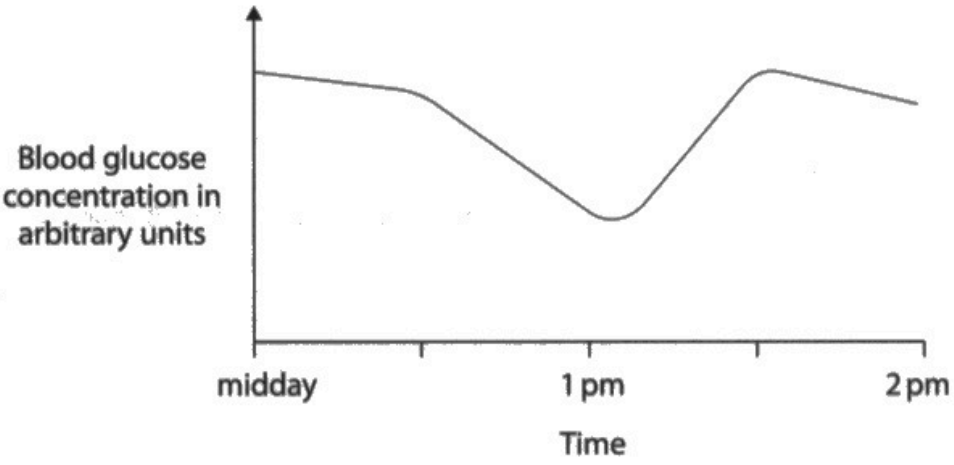


Figure 5

(i) Describe the trend from midday to 1 pm.

(2)

at midday ~~it~~ the blood glucose concentration is steadily declining from a high concentration because ~~of~~ the per person has most likley just eaten, then ~~it~~ the blood glucose concentration start to drop faster, due to a possible ~~activit~~ excersise.

ResultsPlus
Examiner Comments

This response scores both marks available for referring to a decrease in blood glucose concentration followed by a faster decrease. It was not necessary to refer to specific times when describing the trend. This candidate has also included some points of explanation, which are not necessary because the command word is 'describe'.

Question 3 (d)(ii)

The reason for the increase in blood glucose concentration from 1.05pm to 1.30pm resulted in a wide range of answers. Many candidates incorrectly stated that the person with type 1 diabetes injected insulin or exercised, both of which would result in a decrease in blood glucose concentration. However, approximately one half of all candidates gained the mark for this question.

(ii) State what a person with type 1 diabetes could have done to cause the change in the blood glucose concentration from 1.05 pm to 1.30 pm.

take insulin

ResultsPlus
Examiner Comments

Taking insulin would not result in an increase in blood glucose concentration from 1.05pm to 1.30pm. Exercise was also a very common response that didn't gain the mark. Eating a meal or having a sugary drink were the responses that scored a mark most frequently.

(ii) State what a person with type 1 diabetes could have done to cause the change in the blood glucose concentration from 1.05 pm to 1.30 pm.

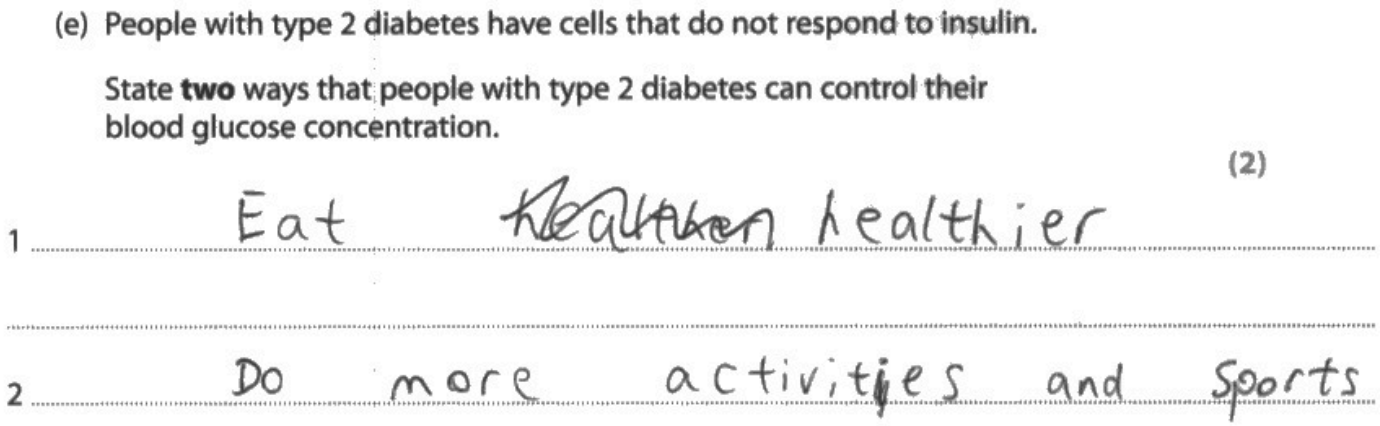
* eaten food or drank a sugary drink (1)

ResultsPlus
Examiner Comments

Either point in this response would score the mark.

Question 3 (e)

The majority of candidates scored at least one mark on this question about how people with type 2 diabetes can control their blood glucose concentration. The most common creditworthy answers were exercise or inject insulin. In many instances candidates referred to ways of monitoring blood glucose concentration rather than controlling it.


(e) People with type 2 diabetes have cells that do not respond to insulin.

State **two** ways that people with type 2 diabetes can control their blood glucose concentration.

(2)

1 Eat healthier healthier

2 Do more activities and Sports

ResultsPlus
Examiner Comments

Comments such as 'eat healthier' or 'have a balanced diet' were insufficient to score the first point on the mark scheme. More specific responses such as reduce sugar intake were required.

'Do more activities and sport' scores the second point on the mark scheme; there is a clear implication that exercise is being recommended.

ResultsPlus
Examiner Tip

If you are writing about diet, be specific about how it could be improved to deal with a particular medical issue such as diabetes. Healthy eating does not tell us what needs to be included in the diet or which foods should be avoided.

(e) People with type 2 diabetes have cells that do not respond to insulin.

State **two** ways that people with type 2 diabetes can control their blood glucose concentration.

1 limit there consumption of sugar

2 exercise to burn the unnecesory ones.

ResultsPlus
Examiner Comments

The two points stated in this response are clear and unambiguous. 'Limit the consumption of sugar' gains the first point on the mark scheme and 'exercise' gains the second point on the mark scheme.

Question 4 (b)

Q04 was focused on gas exchange in humans, the movement of blood from the heart to the lungs, heart rate and cardiac output.

In Q04(b) candidates seemed to be unfamiliar with the general structure of an alveolus and how it is adapted for gas exchange. It was disappointing to note that the majority of candidates failed to score the mark for this question. When the mark was awarded, it was usually for stating large surface area; the other two points on the mark scheme were rarely seen.

(b) State **one** adaptation of an alveolus that increases the rate of gas exchange.

(1)

thick wall

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Examiner Comments

A thick alveolus wall would reduce the rate of gas exchange, so this point does not score a mark.

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Examiner Tip

Check that you know about the structure of an alveolus and all the features it has to increase the rate of gas exchange in the lungs.

(b) State **one** adaptation of an alveolus that increases the rate of gas exchange.

(1)

Thin cell walls

ResultsPlus
Examiner Comments

This response does not score the mark. Cell walls are not found in animal cells, so the cells that make up an alveolus do not have walls. However, 'thin walls' would be credited.

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Examiner Tip

Be very careful about what you write about the adaptations of different structures in plants and animals. Think about the situation outlined in the question and remember that animal cells do not have walls, but plant cells do. You can refer to the walls of the alveolus, but not cell walls.

Question 4 (c)

In general, the movement of blood from the heart to the lungs was poorly understood and some descriptions showed an overall lack of understanding of the circulation of blood. Some good practice was seen where candidates drew basic diagrams to remind them of the route taken by blood from the heart, but it was not common to see the pulmonary artery mentioned. The heart pumping blood was the point that scored a mark most frequently.

(c) Describe how blood is moved from the heart to the lungs.

(2)

comes out of the heart in the pulmonary artery the to the lungs

ResultsPlus
Examiner Comments

The reference to the blood going from the heart to the lungs in the pulmonary artery scores one mark. No other creditworthy points have been written.

ResultsPlus
Examiner Tip

Remember to check the mark allocation for a question and make sure that you have written enough points to score full marks.

(c) Describe how blood is moved from the heart to the lungs.

(2)

The heart pumps oxygenated blood through the pulmonary vein to the lungs

ResultsPlus
Examiner Comments

The heart pumps blood scores the first point on the mark scheme. Unfortunately the candidate has given pulmonary vein instead of pulmonary artery, so just one mark is scored for this question.

ResultsPlus
Examiner Tip

Check that you are familiar with the circulation of the blood in the body. Learn the names of the vessels that take blood away from the heart and return blood to the heart.

Question 4 (d)(i)

This question was answered very successfully, with the vast majority of candidates gaining both marks. Describing the increase in heart rate followed by a decrease and referring to data resulted in most candidates scoring both marks available. There were some very detailed responses and some of these were extended beyond the answer space provided on the script. At the beginning of an examination series, candidates should be given guidance on how to deal with situations where they have insufficient answer space.

(i) Describe the trend shown in Figure 7.

Use data from Figure 7 to support your answer.

(2)

When you exercise you release adrenaline which makes your heart beat faster.

ResultsPlus
Examiner Comments

The candidate has not read the question carefully. Their response is in the style of an explanation, but the question asks them to describe the trend shown, so zero marks scored.

ResultsPlus
Examiner Tip

Always check that you read questions very carefully. Make sure that you answer in a way that matches the command word. Here the command word is 'describe'.

(i) Describe the trend shown in Figure 7.

Use data from Figure 7 to support your answer.

(2)

5 minutes after exercise ~~exercise~~ begins the heart rate starts to increase it continues to rapidly increase at 15 minutes until exercise stops at ~~35~~ 25 minutes. The heart rate decreases and slowly returns back to normal at 45 minutes.

ResultsPlus
Examiner Comments

This is a concise answer that scores both marks available. The candidate has annotated the graph to help them interpret the changes in heart rate. The description of heart rate increasing and decreasing scores the first point on the mark scheme. There are three correct references to data; only one of these would be needed to score the second mark.

Question 4 (d)(ii)

In contrast to the previous item, Q04(d)(ii) was not well answered. Most candidates seemed to miss the 'explain' command word and often just wrote another variation of their answer to Q04(d)(i). If a mark was scored on this item, it was usually for referring to exercise. The other points on the mark scheme were rarely seen.

(ii) **Explain the trend shown in Figure 7 from 5 minutes to 25 minutes.**

(2)

From 5 to 25 minutes the ~~her~~ heart rate increases rapidly because this person is ~~during am~~ exercising which shows the increase of heart rate.

ResultsPlus
Examiner Comments

This answer scores one mark. The candidate knows that the person is exercising, but there is no explanation of the increase in heart rate in terms of more oxygen being required for more respiration.

(ii) Explain the trend shown in Figure 7 from 5 minutes to 25 minutes.

(2)

= as the time in minutes increases as the person is exercising the heart rate increases because the ~~to~~ heart needs to ~~~~ pump more blood to carry more oxygen

ResultsPlus
Examiner Comments

This response scores two marks. The candidate has realised the person is exercising from 5 minutes to 25 minutes. 'Pump blood' does not gain any credit, but carry more oxygen scores a second mark.

Question 4 (d)(iii)

It was very surprising that one half of all candidates were unable to complete at least part of this calculation question to gain some credit. To score marks candidates had to read the heart rate from the graph at 25 minutes, substitute into the equation, then calculate the answer. A large proportion of candidates perhaps did not look at the equation used to calculate cardiac output carefully enough. Instead of reading the heart rate from the graph, many candidates just substituted 25 into the equation. This resulted in zero marks being scored. In some cases candidates were confused by the unit for stroke volume and they cubed 0.13 in their calculations.

(iii) The stroke volume is the volume of blood pumped during one beat of the heart.

At 25 minutes the stroke volume was 0.13 dm^3.

Calculate the cardiac output of the heart of this person at 25 minutes.

Use the equation

cardiac output = stroke volume × heart rate

(3)

$0.13 \times 200 = 26 dm^3$

26 dm^3 per minute

ResultsPlus
Examiner Comments

This response scores three marks. The heart rate at 25 minutes (200) has been read from the graph correctly and substituted into the equation. The final answer is correct.

(iii) The stroke volume is the volume of blood pumped during one beat of the heart.

At 25 minutes the stroke volume was 0.13 dm^3.

Calculate the cardiac output of the heart of this person at 25 minutes.

Use the equation

cardiac output = stroke volume × heart rate

(3)

$0.13^3 \times 200 = 26$ 0.4394

0.4394

~~26~~ ..... dm^3 per minute

ResultsPlus
Examiner Comments

This answer gains one mark for finding the heart rate at 25 minutes (200 beats per minute) from the graph. The candidate has been confused by the unit for stroke volume and has decided to cube that value, so no further marks are scored.

ResultsPlus
Examiner Tip

Always think carefully about the numbers you substitute into equations. You do not need to square values or cube values unless the equation shows that this must be done.

Question 5 (a)

Q05 is about the heart and structure of the blood.

Q05(a) asked candidates to explain why the wall of the left ventricle is thicker than the wall of the right ventricle. As with Q04 that required knowledge of the circulation of blood, this question was answered very poorly. Instead of explaining that thicker walls allow the left ventricle to produce more pressure, many responses referred to the thick walls being able to withstand pressure, which was not a creditworthy point. The majority of candidates knew that the left ventricle pumps blood around the whole body and this was the most common point that gained a mark. However, there was usually very little explanation in the answers seen.

5 (a) The heart pumps blood.

Explain why the wall of the left ventricle of the heart is thicker than the wall of the right ventricle of the heart.

(2)

the left wall is thicker as it has to pump blood to the whole body whereas the right just goes to the lung

ResultsPlus
Examiner Comments

The candidate knows that the left ventricle pumps blood around the body and scores the second point on the mark scheme. There is no reference to the left ventricle being more muscular or providing more pressure to enable blood to be pumped around more of the body.

ResultsPlus
Examiner Tip

Remember to check the command words used in questions. In this question you need to say why the wall of the left ventricle is thicker (because there is more muscle or to provide more pressure) than the wall of the right ventricle. You should then link this to what the left ventricle does – pumps blood around more of the body, not just to the lungs.

5 (a) The heart pumps blood.

Explain why the wall of the left ventricle of the heart is thicker than the wall of the right ventricle of the heart.

(2)

The wall of the left ventricle is thicker, this is because it requires to pump the blood at a high pressure across to the whole body, therefore requiring more muscle for stronger contractions. Whilst, the right ventricle is not as thick as it only pumps deoxygenated blood to the lungs.

ResultsPlus
Examiner Comments

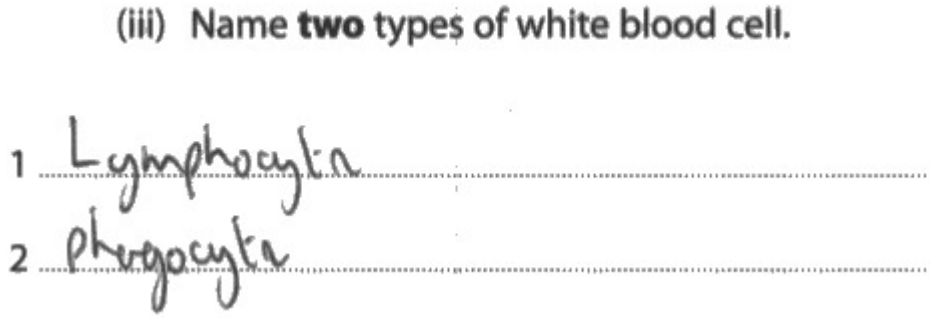
Only a small percentage of candidates wrote answers that scored both points on the mark scheme. In this response, left ventricle 'pumping blood to the whole body' gains one mark and 'therefore requiring more muscle' scores a second mark. The candidate has also given the comparative of the right ventricle pumping blood to the lungs. Pumping blood at high pressure is not creditworthy unless there is a comparative statement.

Question 5 (b)(i)

This question showed a diagram of a sample of blood that had been centrifuged to separate it into different parts. It was very surprising that only a minority of candidates knew that part X is plasma.

Question 5 (b)(iii)

This question asked candidates to name two types of white blood cell. It was disappointing the vast majority were unable to do so. The most common responses that scored marks were phagocyte and lymphocyte, but many spellings were phonetic.


(iii) Name **two** types of white blood cell.

1 Lymphocyta

2 Phygocyta

ResultsPlus
Examiner Comments

Lymphocyte and phagocyte scores two marks. Phonetic spellings of different types of white blood cell were credited.

ResultsPlus
Examiner Tip

Make sure that you are familiar with the different components of the blood. Check that you can spell the names of all the parts of the blood correctly.

(iii) Name **two** types of white blood cell.

1 guard cells

2 memory cells

ResultsPlus
Examiner Comments

This answer scores one mark. Memory cells gains the second point on the mark scheme as an alternative to lymphocytes.

Question 5 (c)(i)

This calculation question was generally answered well, with a large proportion of candidates scoring at least two marks. The main reason for not scoring full marks was because candidates did not follow the instruction to give their answer to the nearest whole number.

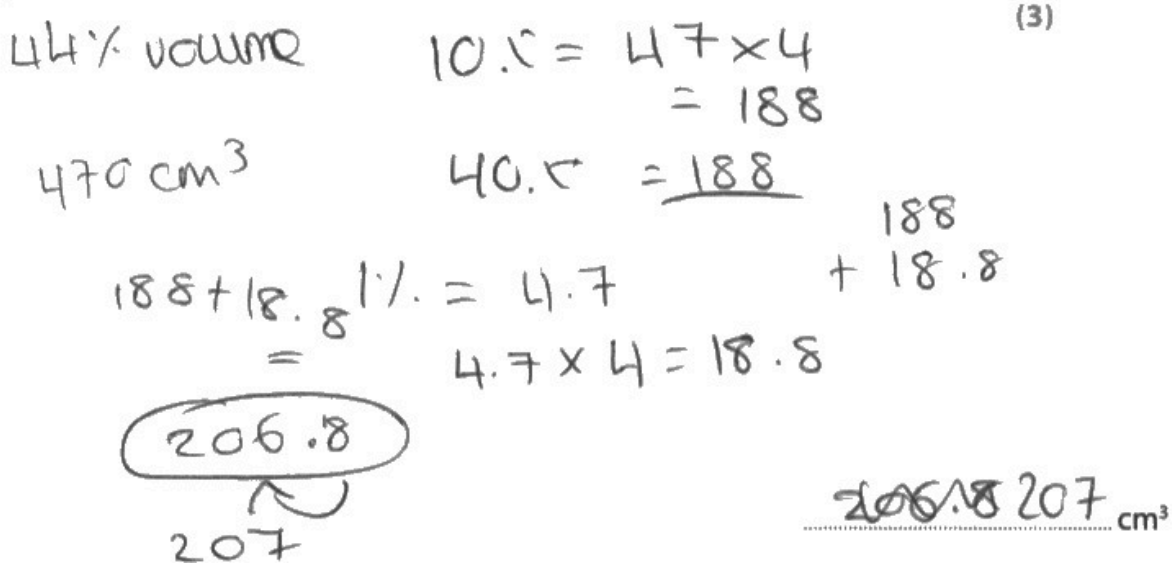
(c) (i) When a person donates blood, 470 cm^3 of blood is removed from their body.

Red blood cells make up 44% by volume of the blood.

Calculate the volume of red blood cells in 470 cm^3 of donated blood.

Give your answer to the nearest whole number.

(3)



ResultsPlus
Examiner Comments

This response scores full marks. The candidate has shown their working and has correctly given their answer to the nearest whole number.

(c) (i) When a person donates blood, 470 cm^3 of blood is removed from their body.

Red blood cells make up 44% by volume of the blood.

Calculate the volume of red blood cells in 470 cm^3 of donated blood.

Give your answer to the nearest whole number.

(3)

$470^3 \times 470^3 \times 0.44 = 47196$

47196 cm^3

ResultsPlus
Examiner Comments

This answer gains one mark. For some reason, in their working, the candidate has cubed the volume of red blood cells. However, the working shows 0.44, which scores one mark.

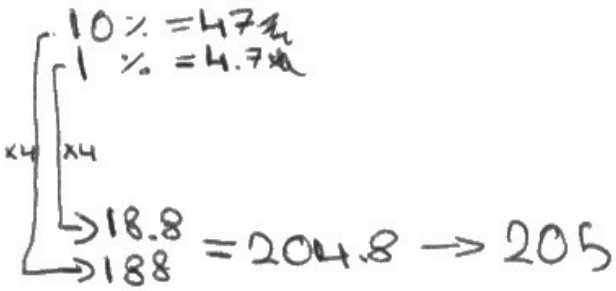
(c) (i) When a person donates blood, 470 cm^3 of blood is removed from their body.

Red blood cells make up 44% by volume of the blood.

Calculate the volume of red blood cells in 470 cm^3 of donated blood.

Give your answer to the nearest whole number.

(3)



205 cm^3

ResultsPlus
Examiner Comments

This answer gains two marks. Part of the working is correct (4.7 shown for 1%) so this scores one mark. The calculated answer of 204.8 is incorrect because there is a mistake in adding 188 plus 18.8. However, the candidate has rounded this answer to 205 and scores a second mark for doing so.

ResultsPlus
Examiner Tip

Always check you working and answers. Simple mistakes can result in marks being lost.

Question 5 (c)(ii)

This question was attempted by most candidates, but many were not able to give at least one relevant precaution that should be taken when collecting a small sample of blood. The majority of creditworthy answers stated wear gloves, or wear a mask, for one mark. Only a much smaller proportion of candidates was successful in stating a second creditworthy precaution. A large number of responses were along the lines of 'use clean needles or clean equipment', which was insufficient to gain credit; the key term on the mark scheme is 'sterile'. In addition, many responses drifted from the question by stating things such as the blood should be checked for diseases. This is not relevant when the question is about collecting a small blood sample.

(ii) Before donating blood, a person has a small blood sample taken to check that the blood is healthy.

State **two** precautions a doctor should take when collecting this sample.

1 Use clean equiptment

2 Use / wear gloves

ResultsPlus
Examiner Comments

Use clean equipment is insufficient to score a mark. Wear gloves was a very common answer and gains the first point on the mark scheme.

ResultsPlus
Examiner Tip

Remember to use precise scientific language in your answers. In a medical situation we need equipment to be sterile, not just clean.

(ii) Before donating blood, a person has a small blood sample taken to check that the blood is healthy.

State **two** precautions a doctor should take when collecting this sample.

(2)

1 they are wearing gloves to protect themsrom ~~them~~ giving the blood bacteria or blood snoring.

2 They have sterilised the equipment to make sure the blood ~~doesn't~~ doesn't carry any bacteria from it, it needs to be pure.

(Total for Question 5 = 11 marks)

ResultsPlus
Examiner Comments

This is a good response that scores both marks available. It should be noted that the candidate has written more than is necessary. The first line of each point would be sufficient.

Question 6 (a)(i)

Q06(a)(i) asked candidates to identify a structure (the vacuole) in a root hair cell from a plant. A large proportion of candidates seemed to be unfamiliar with the structure of a typical plant cell or plant root hair cell and incorrectly identified X as the nucleus.

Question 6 (a)(ii)

It was very surprising to note that only a minority of candidates knew that root hair cells from plants have a large surface area. Other points on the mark scheme were seen extremely rarely.

(ii) State **one** way that the structure of the root hair cell increases the volume of substances it absorbs.

(1)

It has a long projection which increases its surface area

ResultsPlus
Examiner Comments

This answer gains the mark. The candidate has described a key feature of root hair cells in plants (long projection) and that it has a large surface area. A simple statement such as 'it is long' would also score the mark.

(ii) State **one** way that the structure of the root hair cell increases the volume of substances it absorbs.

(1)

no cell wall.

ResultsPlus
Examiner Comments

Having no cell wall is not an adaptation of root hair cells in plants, so this response does not gain credit. An answer such as the cell walls are thin would score the mark.

ResultsPlus
Examiner Tip

Always think carefully about the context of a question. You would not expect cell walls to be absent in plant root hair cells, but a thinner cell wall would help to increase the volume of substances they absorb.

Question 6 (a)(iii)

This 'explain' question proved to be too demanding for approximately two thirds of candidates. Only a small proportion scored at least one mark and very few scored all three marks. Candidates who fully understood the applied nature of the question often wrote very succinct responses that scored well. Candidates who were clearly unfamiliar with plant root hair cells found this item very difficult with many often referring to human hairs.

(iii) **Explain why root hair cells do not contain chloroplasts.**

(3)

Root hair cells do not contain chloroplasts as they do not undergo Photosynthisis to make food, ~~They does~~ They do also not need chloroplasts as they do not need access to Chlorophyll which makes the plant green.

ResultsPlus
Examiner Comments

This answer scores one mark for being aware that root hair cells do not undergo photosynthesis. If the candidate had developed their answer to explain that root hair cells are underground, so they do not receive light, then the answer would be complete and full marks would be scored.

(iii) Explain why root hair cells do not contain chloroplasts.

(3)

because chloroplast is used for photosynthesis, which requires light, so due to roots being underground or underneath something like soil, they won't reciene light which means they can't photosynthesise, making chloroplast unnessecery.

ResultsPlus
Examiner Comments

This is a very good, well-structured response. It includes all the key elements on the mark scheme – roots are underground, no light and can't photosynthesise.

ResultsPlus
Examiner Tip

Remember to check the number of marks available for a question and try to include that number of points in your answer. Take time to think logically about a question and aim to keep your points brief.

Question 6 (b)

This question asked candidates to describe two ways that the *Elodea* cells in 10% salt solution are different from *Elodea* cells in tap water. Many candidates did not keep their answers straightforward by describing what they could see in Figure 10 and as a result a large proportion did not score marks. Instead of specifically referring to the chloroplasts that were labelled, a large number of responses simply stated 'they'. Descriptions such as 'they are all in the middle' did not gain credit since it was essential to mention chloroplasts. Approximately one third of candidates scored at least one mark; those who accurately described the location of chloroplasts in the two sets of cells could gain both marks available. Some more perceptive candidates scored a mark for describing the difference in the size of the *Elodea* cells. A surprisingly large number of candidates misunderstood the question and the diagram, so instead of writing about cells and chloroplasts, they described particles in solids, liquids and gases.

(b) A student studied the water plant *Elodea*.

The student used a light microscope to observe the cells of the plant in tap water and in a 10% salt solution.

Figure 10 shows *Elodea* cells in tap water and in a 10% salt solution.

Elodea cells in tap water

Elodea cells in 10% salt solution

Figure 10

Describe **two** ways that the *Elodea* cells in the 10% salt solution are different from the *Elodea* cells in tap water.

(2)

1 the chloroplasts are more grouped together.

2 not along the edges, in the centres, of the tap water molecules.

ResultsPlus
Examiner Comments

The first point made does not specifically refer to tap water or salt solution, but the structure of the question implies the latter. So, 'chloroplasts are more grouped together' scores the second point on the mark scheme (clump together). The candidates second description does not gain any credit. It can be assumed that the candidates is still writing about the location of chloroplasts, but the answer is confused; in tap water the chloroplasts **are** along the edges of the cells.

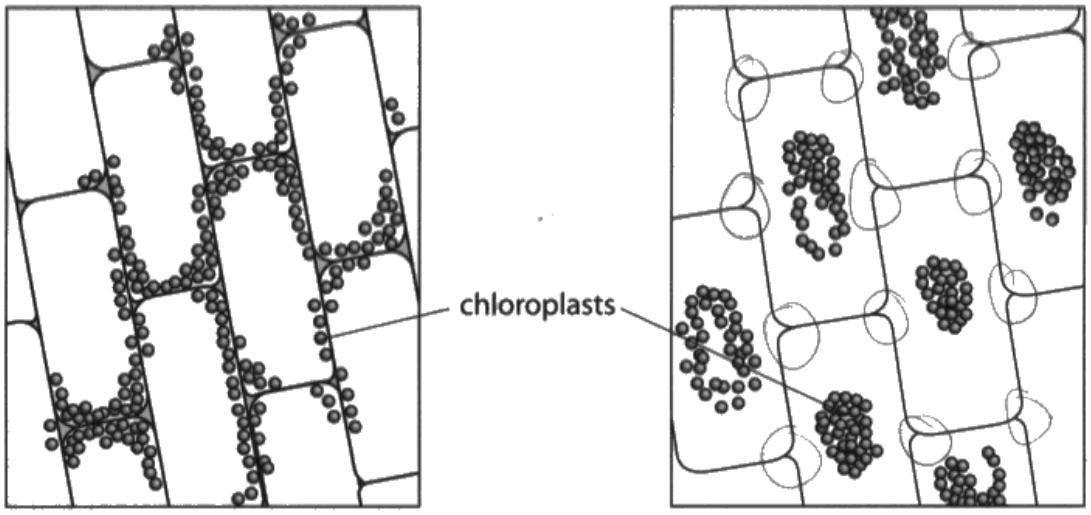
ResultsPlus
Examiner Tip

In 'describe' questions such as this, write about the differences that you can see. The position of chloroplasts is a key difference here, so make sure that you refer to chloroplasts in your answer. Also try to use scientific terms, eg in tap water describe the chloroplasts as being near the cell walls.

(b) A student studied the water plant *Elodea*.

The student used a light microscope to observe the cells of the plant in tap water and in a 10% salt solution.

Figure 10 shows *Elodea* cells in tap water and in a 10% salt solution.



Elodea cells in tap water

Elodea cells in 10% salt solution

Figure 10

Describe **two** ways that the *Elodea* cells in the 10% salt solution are different from the *Elodea* cells in tap water.

(2)

1 The chloroplast is in the center of the cell.

2 ~~The cells are dam. The cells are dead.~~

~~The cells are no give.~~

The cells became larger.

ResultsPlus
Examiner Comments

Both of the candidates descriptions are creditworthy. 'Chloroplasts in the centre' gains the second point on the mark scheme and 'cells became larger' scores the point in additional guidance.

(b) A student studied the water plant *Elodea*.

The student used a light microscope to observe the cells of the plant in tap water and in a 10% salt solution.

Figure 10 shows *Elodea* cells in tap water and in a 10% salt solution.

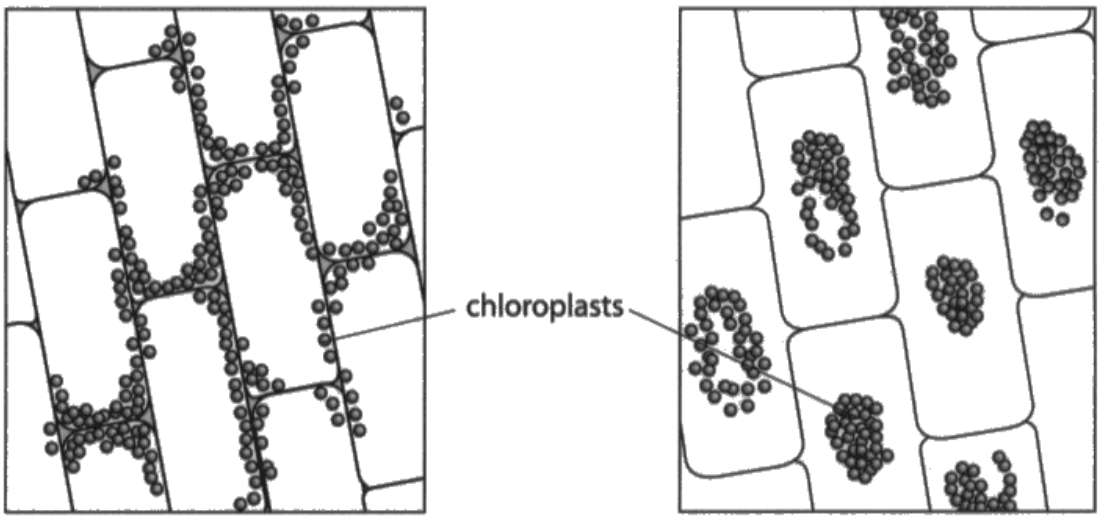


Figure 10

Describe **two** ways that the *Elodea* cells in the 10% salt solution are different from the *Elodea* cells in tap water.

(2)

The cells are together in the salt solution and in tap water they are separated. Inside the tap water the cells are mixed in a bit with little bits of chlorine.

ResultsPlus
Examiner Comments

This response scores zero marks. Instead of writing about chloroplasts, the candidate has referred to cells. The second description shows confusion in understanding the context of the question.

Question 6 (c)

The diagram made this extended open-response question accessible to the vast majority of candidates, enabling them to at least score a mark in Level 1. However, many good explanations that scored marks in Levels 2 and 3 were seen. Many candidates used the terms shown in the indicative content and showed a good knowledge of water movement through plants and the processes involved. In some responses there was confusion between the roles of xylem and phloem and the processes of translocation and transpiration. There were also many instances where candidates described the water cycle in detail; these responses were usually given some credit for referring to plant structures and the evaporation of water from leaves, but few scored marks in Level 3.

*(c) The arrows in Figure 11 show the direction of water movement through a tree.

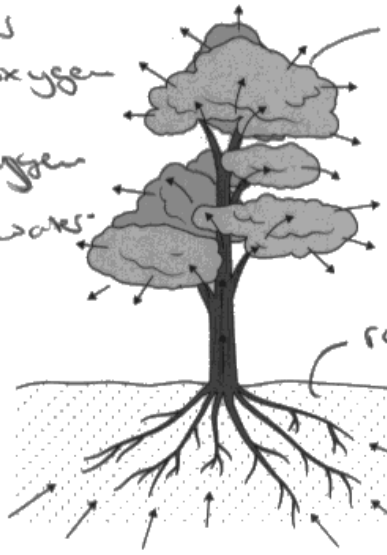


Figure 11

Explain how water is moved from the soil, through the plant and into the air.

(6)

water is taken up out of the soil by the trees roots which then absorb the water and store it. The tree uses the water to photosynthesise which creates glucose and oxygen. When the tree has created glucose and oxygen the tree can then use these products to respire. The tree then uses glucose and oxygen to ~~determin~~ perform respiration which produces carbon dioxide and water. The water then condenses and eventually evaporates into the air to create water vapour which stays in the atmosphere until it cools and condenses.

ResultsPlus
Examiner Comments

The candidate has referred to part of the route taken by water through the plant (roots) and a process involved (evaporation). This is a Level 1 answer scoring two marks.

*(c) The arrows in Figure 11 show the direction of water movement through a tree.

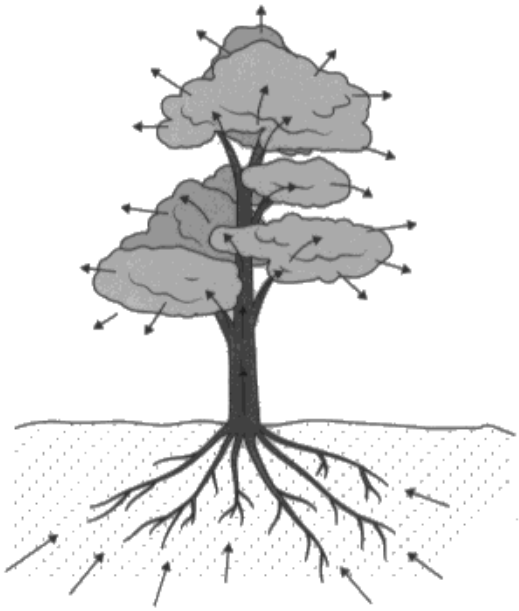


Figure 11

Explain how water is moved from the soil, through the plant and into the air.

(6)

It goes through the roots into the trunk ~~[illegible]~~ then goes up into the air

ResultsPlus
Examiner Comments

This is a very brief response, but it includes more than one part of the route taken by water through the plant. Therefore, this is a Level 2 answer scoring three marks. To score a mark at the top of the level the candidate would need to refer to a process involved in the movement of water, such as osmosis.

*(c) The arrows in Figure 11 show the direction of water movement through a tree.

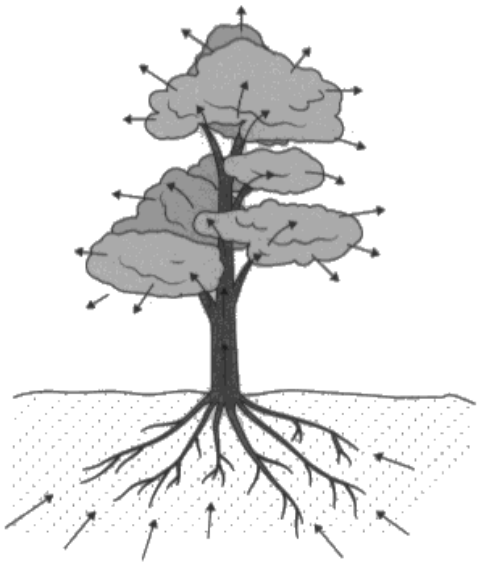


Figure 11

Explain how water is moved from the soil, through the plant and into the air.

(6)

- When it rains the soil soaks up the water underground.
- Then the roots of trees take in some of the water and the water travels through the tree roots.
- The water then travels through the main tree up into the branches.
- The water is then moved into the leaves and helps them grow.
- Some of the water then evaporates into the air.
- The process is then repeated.

ResultsPlus
Examiner Comments

This response describes the route taken by water through the plant. No additional detail about the route has been given eg a reference to root hair cells or xylem, so this is Level 2, not Level 3. There is a comment about water evaporating into the air. This is a simple explanation of water movement, which puts the response at the top of Level 2 and scores four marks.

*(c) The arrows in Figure 11 show the direction of water movement through a tree.

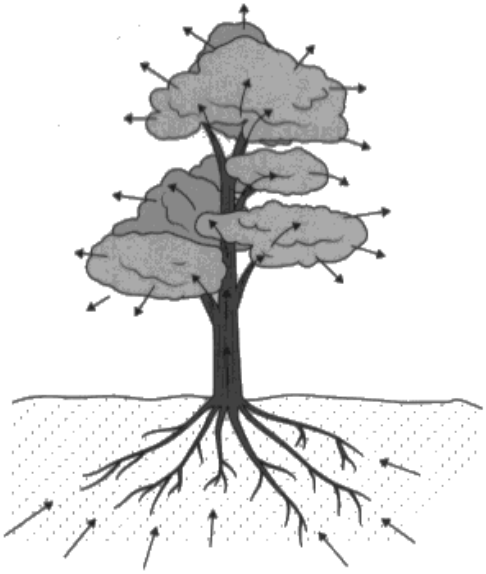


Figure 11

Explain how water is moved from the soil, through the plant and into the air.

(6)

The water is ~~absored~~ absorbed by the roots at the bottom of the tree. Then transported up the trunk of the tree through the xylem and the phloem ensures the water is travelling up towards the stomata (on the leaves). The water travels through the trunks ~~an~~ into the leaves which is then transported by the stomata out of the plant ~~into~~ and into the air. The xylem has thick walls and nutrients. The phloem is inside the ~~xy~~ xylem to push the water upwards. The stomata has layers.

ResultsPlus
Examiner Comments

This response includes the route taken by water through the plant (roots, trunk and leaves). By referring to xylem with thick walls and stomata, there is sufficient detail to put the response into Level 3. The reference to phloem does not detract from the overall quality of the answer. Since there is no explanation of how water moves through the plant, eg a reference to osmosis or transpiration, the answer remains at the bottom of Level 3. Five marks awarded.

*(c) The arrows in Figure 11 show the direction of water movement through a tree.

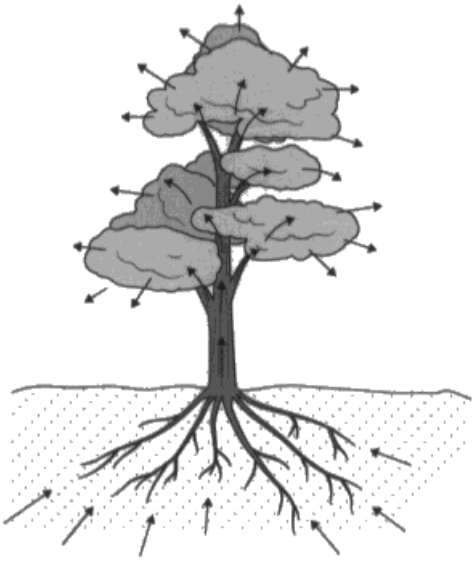


Figure 11

Explain how water is moved from the soil, through the plant and into the air.

(6)

Root hair cells in the plant have hair-like structures that stick into the soil and absorb mineral ions and water which is transferred through phloem and xylem tubes to the rest of the plant including leaves and stomata. Root hair cells also have a large surface area to absorb as much nutrients as they can. Phloem tubes are tubes of elongated living cells that carry food substances, like sucrose, through the plant. Xylem tubes have dead cells that carry water and mineral ions through the plant. Guard cells control what goes in and out of the plant by swelling up with water. Then, transpiration occurs which is the loss of water vapour of the plants leaves, and it is evaporated into the air. Meristems is where stem cells are made, which can differentiate into other cells to carry out different functions.

ResultsPlus
Examiner Comments

This a very detailed response that shows a good understanding of the movement of water through plants. The route through the plant is detailed and includes references to root hair cells, xylem and guard cells. This is a Level 3 answer. The function of phloem has been explained and this does not detract from the overall quality of the response. Transpiration and the evaporation of water are given as explanations of water movement, so six marks can be awarded. The last sentence about meristems is irrelevant and can be ignored.

Paper Summary

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 that 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 their 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 it flows, while also remembering that accurate spelling and grammar in these questions is important.

Grade boundaries

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