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# Examiners' Report
# June 2025

## GCSE Combined Science 1SC0 2BF

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June 2025

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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 hormones and endocrine glands, insulin and the control of blood glucose concentration, type 2 diabetes, photosynthesis, the nitrogen cycle, the structure of the human heart, blood circulation, blood vessel structure, exercise and heart rate, aerobic respiration, and fieldwork techniques.

Questions designed to assess practical skills included investigating the rate of respiration in maggots and devising a plan to estimate the number of named plant species growing in a field.

The assessment of mathematical skills included completing a bar chart, using data from a pie chart to calculate the mass of fertiliser used by crops and determining how far a bubble would move along a capillary tube in five minutes.

In general, this was an accessible paper, with the majority of candidates attempting to answer all questions. Questions where marks could be gained by extracting and interpreting information from diagrams, tables of data and graphs were answered well.

Relatively few candidates scored full marks on the questions with the command word ‘explain’. In some instances this was because they did not grasp what the question was asking. In other cases it was because they did not give the scientific information needed to support their answers, or were unable to apply their knowledge to unfamiliar situations.

It was pleasing to note that the majority of candidates who attempted the extended open response question were able to gain a mark in at least level one. Some very good responses were seen from candidates who had clearly undertaken practical fieldwork techniques to estimate plant populations. Candidates who were unfamiliar with ecology fieldwork techniques understandably did not score very highly on this ‘devise a plan’ question.

# Question 1(a)

Matching box questions are a regular feature of combined science foundation papers. In recent series most candidates have followed the advice to draw one straight line between two boxes. However, a small proportion of candidates still forget to follow this instruction. In this question most candidates could link insulin to pancreas, but they were less sure about the endocrine gland that produces oestrogen.

# Question 1(b)i

Candidates had to read the highest blood glucose concentration from the y axis of a graph. Although the scale on the graph was quite small, most candidates could state an appropriate value that was within acceptable tolerance limits as shown on the mark scheme.

(b) Figure 1 shows the concentration of glucose in the blood of a person for a period of six hours.

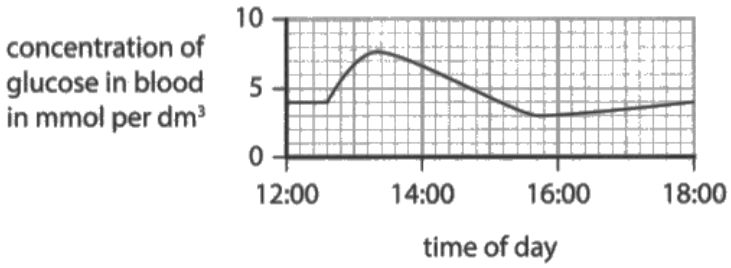



**Figure 1**

(i) State the highest blood glucose concentration during this six hour period.

**(1)**

7 mmol per dm³

ResultsPlus
Examiner Comments

This is not a creditworthy response. The correct answer on the mark scheme is 7.6 mmol per dm 3. Values from 7.2 to 8.0 mmol per dm 3 were accepted.

ResultsPlus
Examiner Tip

Always check that you understand the scale on a graph before reading off values.

# Question 1(b)ii

In this question, candidates had to describe the changes in the concentration of glucose in the blood by interpreting patterns in a graph. Instead of adhering to the range of times given in the question, some candidates confused their answers by referring to an increase at or before 13:30, before going on to say that the concentration of glucose in the blood decreases then increases. Some good references to data points were seen, although these were not necessary to gain full marks on this question. Many candidates scored just one mark for describing the overall decrease in blood glucose concentration from 13:30 to 18:00.

(ii) **Insulin was released from the pancreas at 13:30.**

**Describe the changes in the concentration of glucose in the blood from 13:30 to 18:00.**

(7.5) (2)

Originally at 13:30 there's an increase in concentration, however by 18:00 it has decreased back to its normal levels (4)

ResultsPlus
Examiner Comments

The first part of this description is incorrect. It is true to say that the concentration of glucose in the blood reaches a peak just before 13:30, but it does not increase at 13:30. However, there is a description of an overall decrease between 13:30 and 18:00, so this scores one mark.

ResultsPlus
Examiner Tip

Always check your facts when describing trends in data. Incorrect references to data could mean that you are not credited for some of the changes you describe. In this question, the concentration of glucose in the blood does not increase at 13:30, it is decreasing at this point.

(ii) Insulin was released from the pancreas at 13:30.

Describe the changes in the concentration of glucose in the blood from 13:30 to 18:00.

(2)

It gradually decreased during hours 13:30 to approximately 4 then slightly increased by 1 mmol per $dm^3$ from 16:00 to 18:00.

ResultsPlus
Examiner Comments

This is a good response that scores both marks. A decrease in the concentration of glucose in the blood, followed by an increase, has been described.

# Question 1(c)

Questions related to diabetes and the control of blood glucose concentration have appeared on several papers in recent examination series. Although most candidates scored at least one mark on this question, usually for exercise, some very muddled answers were seen. A lack of understanding of this area of the specification was shown and there was confusion with type 1 diabetes. References to diet were commonplace, such as eat a healthy diet or eat a balanced diet. The key thing missing from these responses was a comment about controlling diet.

(c) The cells of people with type 2 diabetes do not respond to insulin.

Describe **two** ways that a person with type 2 diabetes can control the concentration of glucose in their blood.

**(2)**

1 Control the amount of sugar intake

2 Do more exercise to regulate concentration of glucose.


This response scores two marks. Correct references to controlling diet, or controlling an aspect of diet, were not commonplace. However, references to exercise were seen very frequently and this was often the only mark awarded.

# Question 2(a)

Most candidates knew that carbon dioxide and oxygen are the missing parts of the word equation, but many transposed these gases and therefore, failed to gain any marks. Some candidates lost marks because they used incorrect symbols for the gases, particularly carbon dioxide, such as Co2 or CO2.

**2** Plants produce glucose by photosynthesis.

(a) Complete the word equation for photosynthesis shown in Figure 2.

**(2)**

water + oxygen ⟶ glucose + carbon dioxide

**Figure 2**

ResultsPlus
Examiner Comments

This response is incorrect. Oxygen and carbon dioxide are each on the wrong side of the equation.

**2** Plants produce glucose by photosynthesis.

(a) Complete the word equation for photosynthesis shown in Figure 2.

**(2)**

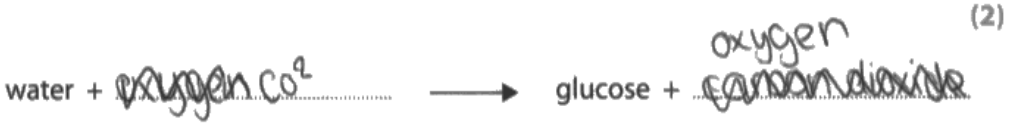



**Figure 2**

ResultsPlus
Examiner Comments

This response scores one mark for oxygen. The formula for carbon dioxide is incorrect; it should be CO 2.

ResultsPlus
Examiner Tip

If you are unsure about the correct symbols and formulae to use for elements and compounds, it is always better to write the names.

# Question 2(b)i

This question asked why photosynthesis does not occur in the roots of plants. The question was well-answered, with the majority of candidates scoring the mark for stating that light does not reach the roots.

(b) (i) State why photosynthesis does **not** occur in the roots of plants.

**(1)**

because the sun can't reach the roots of plants because soil absorbs water.

ResultsPlus
Examiner Comments

This response was not awarded a mark because there is no reference to light.

ResultsPlus
Examiner Tip

Remember that light or sunlight is required for photosynthesis. On its own, just stating that the Sun is needed for photosynthesis is insufficient.

(b) (i) State why photosynthesis does **not** occur in the roots of plants.

**(1)**

because there are no chloroplasts in the roots due to there being no light

ResultsPlus
Examiner Comments

This is a good answer. Relatively few candidates stated that there are no chloroplasts in roots. The reference to no light is also creditworthy.

# Question 2(c)

In this question, candidates had to describe the role of chlorophyll in leaf cells. The stem of the question referred to green leaf cells, so no credit was given for comments about chlorophyll making leaves green. Although there was a large proportion of incorrect responses, some good answers were seen, with many of them referring to chlorophyll absorbing light for photosynthesis. Answers referring to chlorophyll being found in chloroplasts were much less common.

(c) Chlorophyll is found in green leaf cells.

Describe the role of chlorophyll in leaf cells.

**(2)**

Chlorophyll is a green pigment that allows the leaf to take energy from the sun.

ResultsPlus
Examiner Comments

'Take energy from the Sun' is insufficient to score the second point on the mark scheme. There must be a reference to absorbing light or sunlight for this mark.

(c) Chlorophyll is found in green leaf cells.

Describe the role of chlorophyll in leaf cells.

(2)

it gives the leaves the green pigment which allows them to absorb lots of Sunlight

ResultsPlus
Examiner Comments

Absorbing sunlight scores the second point on the mark scheme. The reference to a green pigment is not creditworthy.

(c) Chlorophyll is found in green leaf cells.

Describe the role of chlorophyll in leaf cells.

**(2)**

Gives them a green colour and allows photosynthesis to happen. through the leaf absorbing light from the sun.

ResultsPlus
Examiner Comments

This is a good response. Absorbing light and allowing photosynthesis scores two marks.

(c) Chlorophyll is found in green leaf cells.

Describe the role of chlorophyll in leaf cells.

**(2)**

chlorophyll is inside chloroplasts and it absorbs light energy for photosynthesis


This is a good concise response. Chlorophyll is inside chloroplasts scores the first point on the mark scheme; absorbs light energy scores the second point on the mark scheme. Photosynthesis could also be credited if the maximum mark for the question had not already been reached.

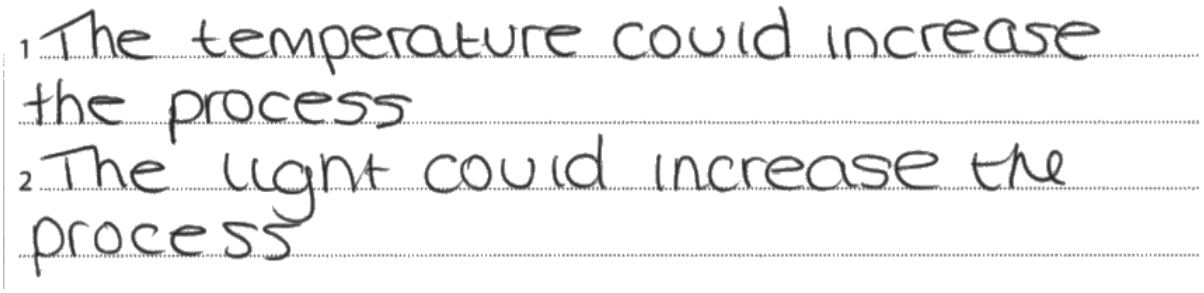
# Question 2(d)

It was pleasing to note that many candidates were able to apply knowledge of burning a fuel to a question about increasing the rate of photosynthesis in a greenhouse. Heating up the greenhouse and producing carbon dioxide were the most common creditworthy answers. As with Q02(a), candidates who used incorrect symbols for carbon dioxide did not gain any credit.

(d) A greenhouse contained an oil burning heater.

State **two** ways this could increase the rate of photosynthesis in the greenhouse.

**(2)**



ResultsPlus
Examiner Comments

This response does not indicate how temperature is changing. If the candidate had written that an increase in temperature (due to the heater) could increase the rate of photosynthesis, then a mark would be awarded. References to the heater producing light were credited, so overall, this answer scores one mark.

(d) A greenhouse contained an oil burning heater.

State **two** ways this could increase the rate of photosynthesis in the greenhouse.

**(2)**

1 because the temperature is increased & the rate of photosynthesis will increase

2 Another way would be more ~~CO~~ carbon dioxide concentration will form which will increase the rate of photosynthesis. ~~and as when~~

**(Total for Question 2 = 8 marks)**

ResultsPlus
Examiner Comments

The candidate has given two detailed statements about how an oil burning heater in a greenhouse can increase the rate of photosynthesis. References to the heater producing water or making the greenhouse more humid were also credited.

ResultsPlus
Examiner Tip

Remember to think about the structure of your response and try to avoid writing below the answer lines.

# Question 3(a)

Most candidates attempted to answer this sentence completion question, but a large proportion did not know that the nitrogen compounds in plants include proteins. Animal and lipids were commonly used to complete the first sentence. The majority of candidates knew that decomposers release nitrates into the soil.

# Question 3(b)i

In this question, candidates had to read a value from a pie chart and use this to calculate the mass of nitrates from human-made fertiliser used on crops. Most candidates identified 55% correctly and many of them could calculate 55% of 180, giving 99 as their answer for two marks. Some candidates changed 180 million tonnes to 180 000 000 tonnes and calculated 55% of that. Answers of 99 000 000 only scored one mark, unless the word 'million' was crossed through on the answer line.

(b) 180 million tonnes of nitrates were used by crops growing on farms in the UK in 2020.

Figure 4 shows the different sources of nitrates used by the crops.

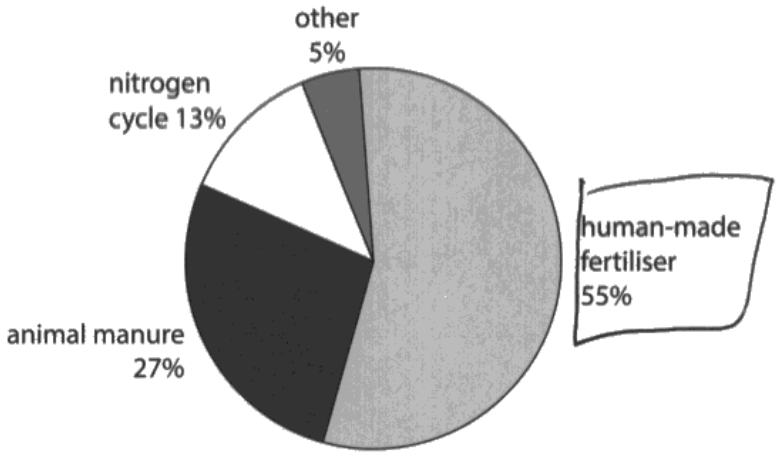



**Figure 4**

(i) Calculate the mass of nitrates from human-made fertiliser that was used by crops in 2020.

**(2)**

180 million × 55% =

9900000 million tonnes

ResultsPlus
Examiner Comments

Although not shown on the paper, the candidate appears to have converted 180 million to 180 000 000 in their working. An answer of 99 000 000 would have scored one mark, but there is a power of 10 error, so this response scores zero.

ResultsPlus
Examiner Tip

In calculation questions, always check your working and the units given on the answer line. Sometimes the unit in the question is different to the unit in the answer, so you have to convert one to another. In this question the unit on the answer line is the same as the unit in the stem of the question (million tonnes) so there is no need to convert 180 million to 180 000 000.

(b) 180 million tonnes of nitrates were used by crops growing on farms in the UK in 2020.

Figure 4 shows the different sources of nitrates used by the crops.

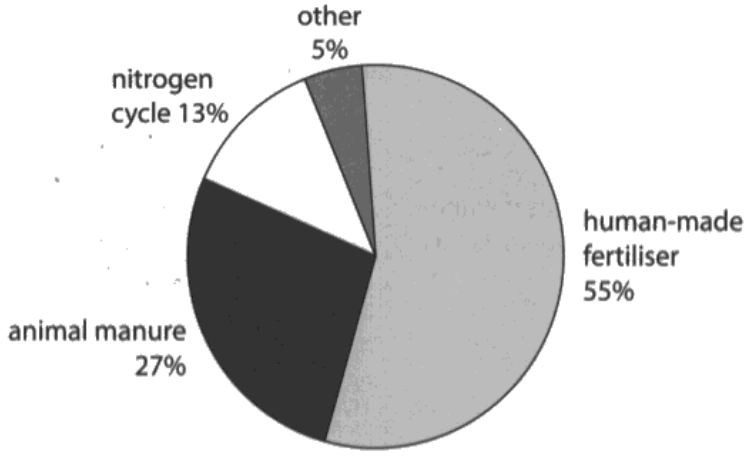



**Figure 4**

(i) Calculate the mass of nitrates from human-made fertiliser that was used by crops in 2020.

9 90000000

(2)

180 000 000

10% = 180 00000

50% = 90000000

99000000 million tonnes

ResultsPlus
Examiner Comments

The candidate has converted 180 million to 180 000 000. They have correctly calculated 55% of 180 000 000, so this answer scores one mark.

(b) 180 million tonnes of nitrates were used by crops growing on farms in the UK in 2020.

Figure 4 shows the different sources of nitrates used by the crops.

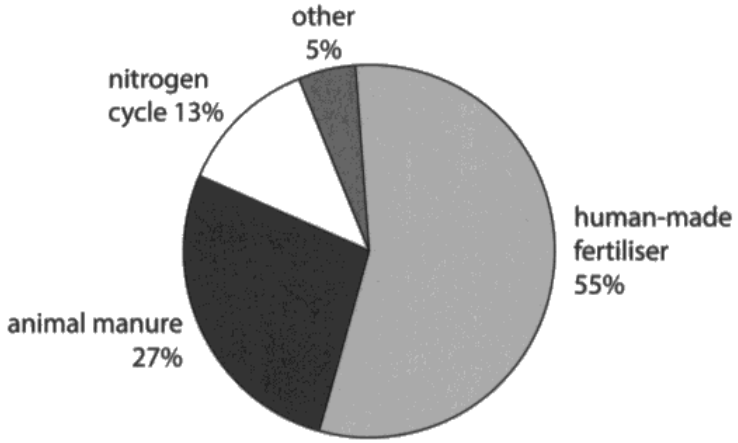



**Figure 4**

(i) Calculate the mass of nitrates from human-made fertiliser that was used by crops in 2020.

**(2)**

1.8 = 1% 180 ÷ 100 = 1.8

1.8 × 55 = 99

99 million tonnes

ResultsPlus
Examiner Comments

This is the expected answer with working shown. Two marks awarded.

# Question 3(b)ii

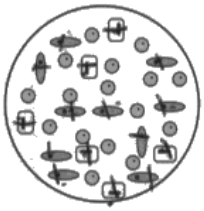
This question was about nitrate fertilisers getting into lakes. It was disappointing that only a tiny proportion of candidates could give the correct answer of eutrophication. Nitrate pollution and water pollution were common answers that did not gain any credit.

# Question 3(c)i

Most candidates could count the number of algae L and algae M in lake Z, then go on to plot these values on the bar chart. Some candidates found it difficult to decipher the scale on the y axis and did not draw the bar for algae M correctly.

(c) A student investigated how the concentration of nitrate affected the types of algae growing in three lakes.

Figure 5 shows microscope images of the algae in 1 $mm^3$ of water, and the concentrations of nitrate ions in each lake.

| | lake X | lake Y | lake Z |
|---|---|---|---|
| microscopic view showing algae in 1 $mm^3$ of lake water |  |  |  |
| concentration of nitrate ions in mols per $dm^3$ | 2 | 5 | 8 |

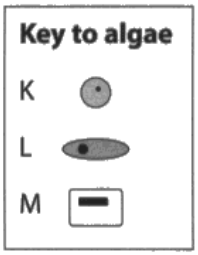



**Figure 5**

(i) Figure 6 shows a bar chart for the algae in lakes X, Y and Z.

Complete the bar chart for algae L and algae M in lake Z.

**(2)**

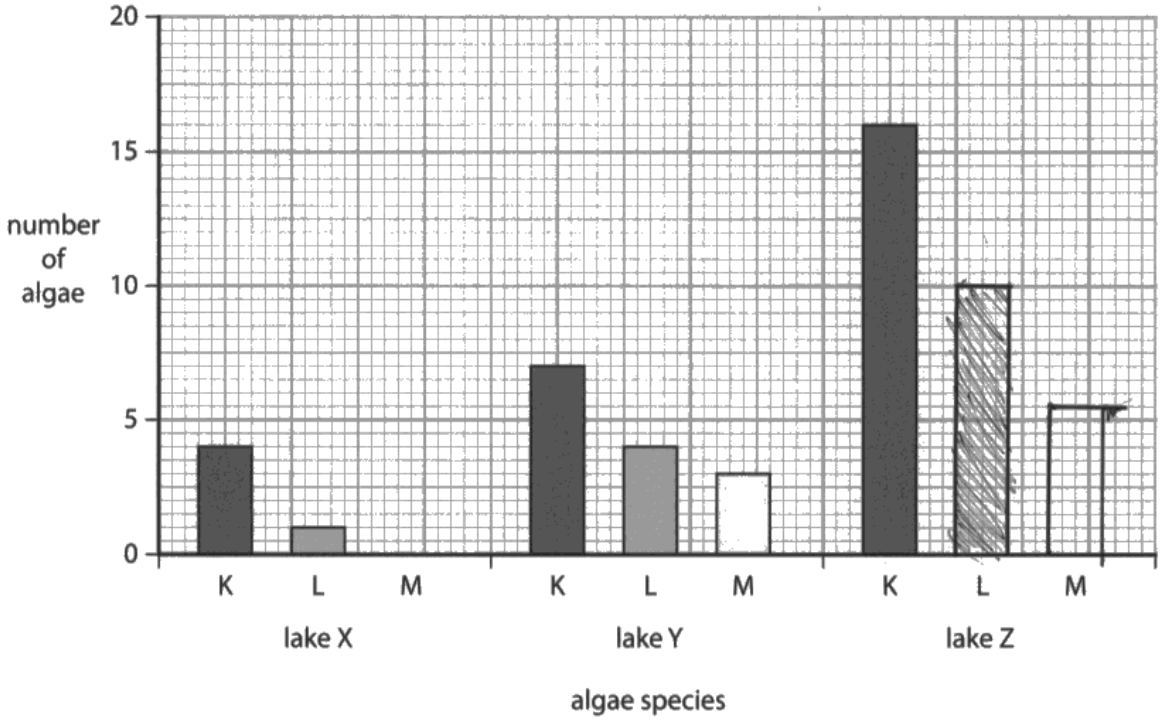



**Figure 6**

ResultsPlus
Examiner Comments

This response scores one mark. The bar for algae M is incorrect. A plotting tolerance of plus or minus one half of a small square was allowed. As in this example, the bar for M was often drawn inaccurately by one whole small square.

ResultsPlus
Examiner Tip

Always check that you understand the scales on graph axes. On the y axis of this bar chart, two small squares represent one of the algae.

(c) A student investigated how the concentration of nitrate affected the types of algae growing in three lakes.

Figure 5 shows microscope images of the algae in 1 $mm^3$ of water, and the concentrations of nitrate ions in each lake.

| | lake X | lake Y | lake Z |
|---|---|---|---|
| microscopic view showing algae in 1 $mm^3$ of lake water |  |  |  |
| concentration of nitrate ions in mols per $dm^3$ | 2 | 5 | 8 |

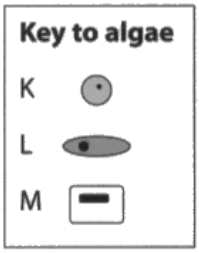



**Figure 5**

(i) Figure 6 shows a bar chart for the algae in lakes X, Y and Z.

Complete the bar chart for algae L and algae M in lake Z.

**(2)**

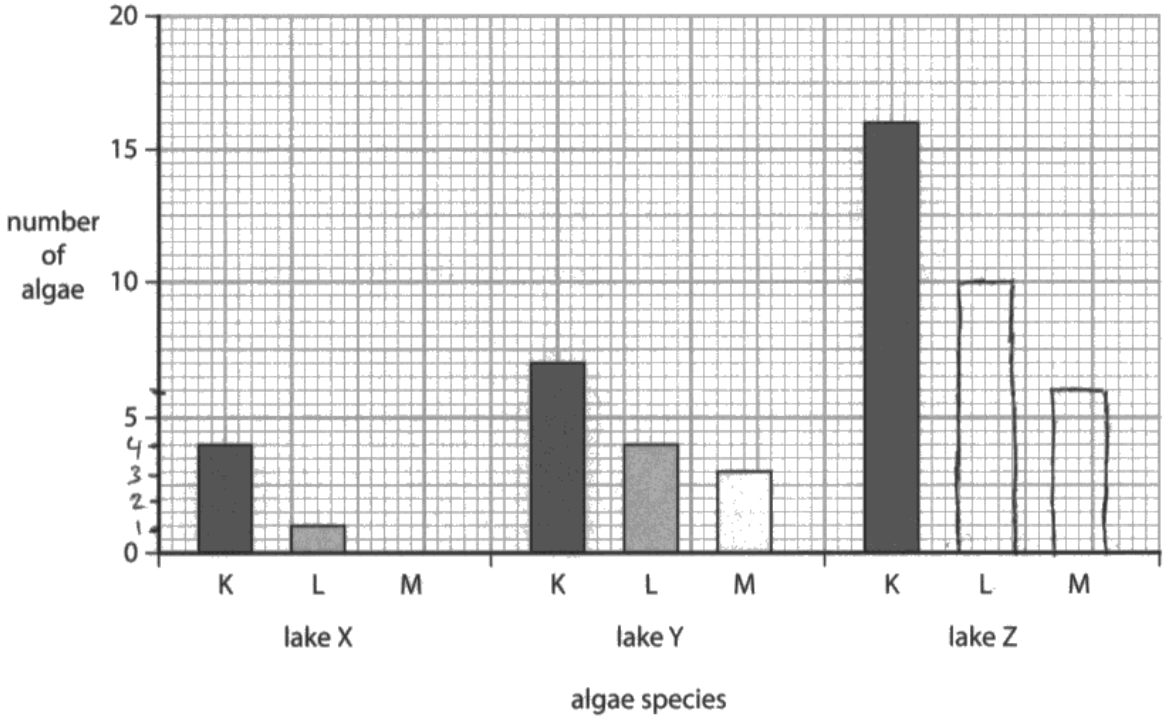



**Figure 6**

ResultsPlus
Examiner Comments

This response scores both marks. Note that the candidate has annotated the scale on the y axis to help with plotting accuracy.

# Question 3(c)ii

This question asked candidates to state two conclusions about the relationship between nitrate concentration and the algae in the lakes. 'The more nitrates, the bigger the number of algae' was a typical response scoring one mark. Relatively few candidates could give a second correct conclusion, such as 'when nitrate concentration increases, the number of types of algae increases'. Some candidates wrote a second conclusion that was simply the opposite of the first conclusion. This did not merit the award of a second mark.

Many responses implied that the relationship was reversed and the number of algae influenced nitrate concentration. Answers such as 'the more algae, the more nitrates' were not credited.

(ii) State **two** conclusions about the relationship between nitrate concentration and the algae in these lakes.

**(2)**

1 More algae, more nitrates,

2 Less algae, less nitrates

**ResultsPlus**
**Examiner Comments**

The relationship between nitrate concentration and algae in the lakes has been reversed in this response, so zero marks awarded.

**ResultsPlus**
**Examiner Tip**

Writing a second conclusion that is the opposite of the first conclusion will not score an extra mark.

(ii) State **two** conclusions about the relationship between nitrate concentration and the algae in these lakes.

**(2)**

1 the higher the concentration of nitrate, the more algae there are

2 the higher the concentration the wider the variety of Algae

ResultsPlus
Examiner Comments

This response scores two marks. The first conclusion seen here was the most common answer that scored one mark. Many candidates found it difficult to write a second valid conclusion such as the one in this response. Variety of algae was accepted for different species of types of algae.

# Question 4(a)i-aii

Q04(a)(i) required candidates to measure the length of a line on a diagram of the heart. Many could do this correctly and the mark scheme included a tolerance of +/- 1 mm. A surprisingly large number of candidates measured in centimetres and gave an answer of 0.5 which was not credited; they seemed to miss the units given on the answer line (mm).

In Q04(a)(ii) candidates were asked to describe how deoxygenated blood leaves the right side of the heart and becomes oxygenated. It was common to see annotations on the diagram of the heart. However, blood vessels were frequently named incorrectly, which did not help with this question or Q04(c). The idea of the right ventricle contracting to push blood to the lungs was a typical answer that scored full marks. Relatively few candidates correctly referred to blood going through the pulmonary artery and only a small proportion mentioned that deoxygenated blood absorbs oxygen in the lungs.

**4** Figure 7 shows the structure of the human heart and the direction of blood flow.

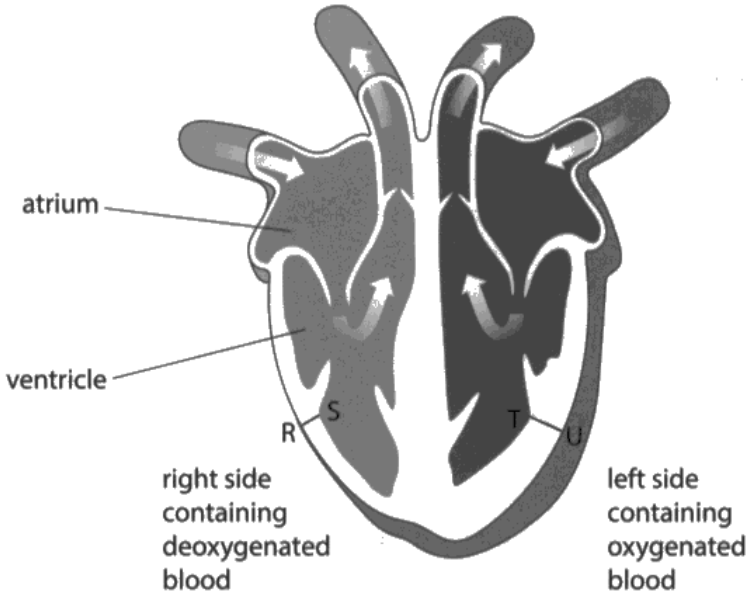



**Figure 7**

(a) (i) Measure the thickness of the left ventricle wall between points T and U.

**(1)**

6cm = 6000mm

T–U = 6.000 mm

(ii) Describe how deoxygenated blood leaves the right side of the heart and becomes oxygenated.

**(2)**

The deoxygenated blood ~~be too~~ ~~the~~ travels through the right ventricle. The right ventricle pumps the blood ~~the~~ to the lungs for oxygen.

ResultsPlus
Examiner Comments

Q04(a)(i) This response scores zero marks. The working shows misunderstanding of converting centimetres to millimetres Q04(a)(ii). This is a typical response scoring both marks - one mark for right ventricle pumps the blood and a second mark for to the lungs.

ResultsPlus
Examiner Tip

Make sure that you learn how to convert one unit into another, such as millimetres into centimetres or metres and grams into kilograms.

**4** Figure 7 shows the structure of the human heart and the direction of blood flow.

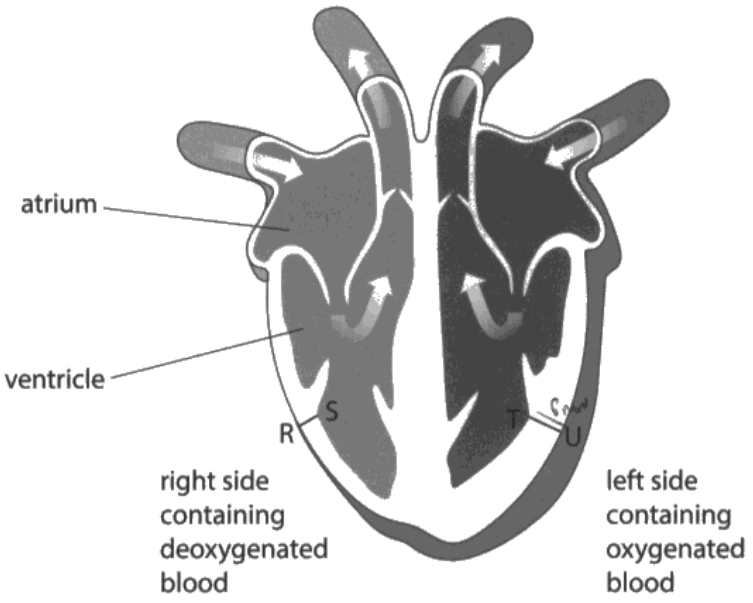



**Figure 7**

(a) (i) Measure the thickness of the left ventricle wall between points T and U.

**(1)**

T–U = 6 mm

(ii) Describe how deoxygenated blood leaves the right side of the heart and becomes oxygenated.

**(2)**

The Vena Cava will bring the blood into the right atrium then to the right Ventricle then to the pulmonary artery, to the lungs and it comes back in Oxygenated through the pulmonary vein then to the left ~~Ventricle~~ atrium then to the left Ventricle and finally it leaves through the aorta Oxygenated again.

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Examiner Comments

Q04(a)(i) A range of 4 mm to 6mm was accepted for the length of the line T-U, so this answer scores the mark. Q04(a)(ii) This response includes extra detail about the circulation of blood. The reference of pulmonary artery to the lungs scores full marks.

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Examiner Tip

This question asks about how blood leaves the right side of the heart to become oxygenated. It is not necessary to describe the full circulation of blood to the right side and back again. Always try to focus on what the question asks.

**4** Figure 7 shows the structure of the human heart and the direction of blood flow.

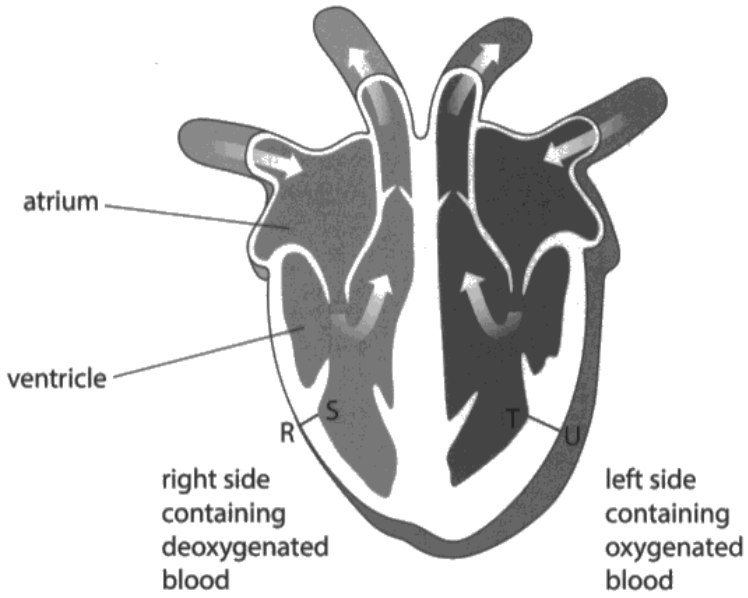



**Figure 7**

(a) (i) Measure the thickness of the left ventricle wall between points T and U.

**(1)**

T–U = ~~5~~ 5 mm

(ii) Describe how deoxygenated blood leaves the right side of the heart and becomes oxygenated.

**(2)**

Deoxygenated blood is pumped out of the right side of the heart and into the lungs where oxygen is diffused in, before re-entering the left side of the heart to be pumped to the whole body

ResultsPlus
Examiner Comments

Q04(a)(i) The line T-U has been measured accurately. Q04(a)(ii) Blood pumped into the lungs scores one mark and oxygen diffused in (to the blood) scores a second mark. Only a small proportion of candidates made a correct reference to the diffusion of oxygen.

# Question 4(b)

In this question, candidates had to refer to the diagram of the heart and state the number of valves in the right side of the heart. Although many candidates gave the correct answer of two, a surprising number of other values was seen.

# Question 4(c)

Candidates were asked to describe what happens to blood when the left ventricle contracts. A typical response described blood being pushed or pumped around the body and this scored two marks. Relatively few candidates scored a third mark by referring to blood flowing through a valve or flowing into the aorta. A lack of knowledge of the names of blood vessels and the structure of the circulatory system meant that many answers were rather confused.

(c) The heart is part of the circulatory system.

Describe what happens to the blood when the left ventricle contracts.

**(3)**

when the left ventricle contracts it puts pressure on the left part of the heart it also allows the oxygenated blood to leave the heart and the deoxygenated blood to enter.

ResultsPlus
Examiner Comments

This answer scores one mark for conveying the idea that blood in the left ventricle is put under pressure, causing it to leave the heart. There is no reference to blood vessels or where the blood is pumped to.

(c) The heart is part of the circulatory system.

Describe what happens to the blood when the left ventricle contracts.

(3)

This causes the oxygenated blood to leave through the aorta and travel all around the body for respiration.

ResultsPlus
Examiner Comments

This response scores two marks. Blood leaving through the aorta scores the third point on the mark scheme and the idea of the blood travelling around the body gains the fourth point on the mark scheme. The phonetic spelling of aorta can be accepted.

(c) The heart is part of the circulatory system.

Describe what happens to the blood when the left ventricle contracts.

(3)

blood gets pumped out to the rest of the body going through the aorta and then filling the veins.

ResultsPlus
Examiner Comments

This is a very concise answer that scores all three marks. 'Blood gets pumped out' is acceptable for blood is put under pressure. The reference to the rest of the body and the aorta score the other two marks.

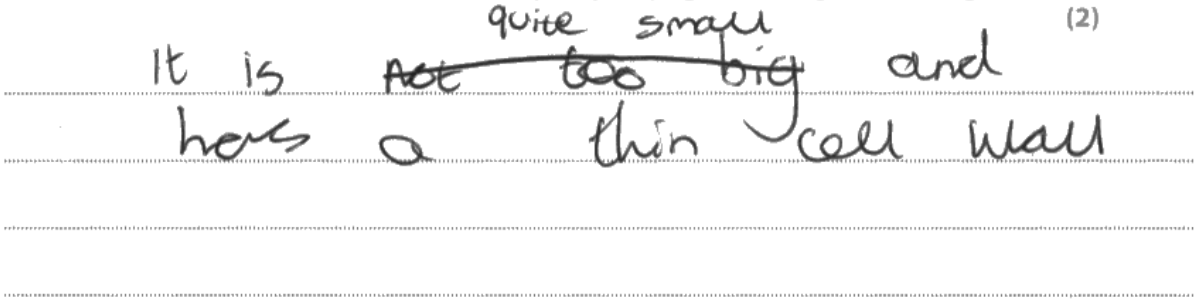
# Question 4(d)i

Most candidates could identify blood vessel C in Figure 8 as a vein.

# Question 4(d)ii

Few candidates had sufficient knowledge of the structure of capillaries to describe how they help gas exchange in the lungs. Having thin walls was the most common structural feature described, followed by a large surface area. Only a small proportion of candidates knew that capillary walls are permeable or that their structure increases the rate of diffusion.

(ii) Describe how the structure of a capillary helps gas exchange in the lungs. (2)



ResultsPlus
Examiner Comments

This response is not creditworthy. References to capillaries being small were ignored. Thin cell wall is incorrect, but just 'they have a thin wall' would have scored the second point on the mark scheme.

ResultsPlus
Examiner Tip

Always check that your answers do not muddle up ideas. Capillaries are found in animals, so they do not have cell walls.

(ii) Describe how the structure of a capillary helps gas exchange in the lungs.

(2)

a capillary is one cell thick so gases like carbon dioxide ~~gas~~ and oxygen have a shorter distance to diffuse

ResultsPlus
Examiner Comments

This concise answer scores two marks. One cell thick gains the second point on the mark scheme and shorter distance to diffuse scores the fourth point on the mark scheme.

# Question 5(a)

This question was attempted by most candidates, but it was misunderstood by many of them. Very few candidates wrote succinct answers explaining that an increase in heart rate when running results in blood being pumped around the body faster, because muscles need more oxygen and glucose for respiration. Correct references to more respiration or greater energy requirements when running were seen infrequently. Many candidates conflated information about breathing rate with heart rate, which generally made their answers confused.

**5** (a) Explain why a person's heart rate increases when they are running compared with when they are at rest.

**(2)**

because the hearts working harder to pump blood all across the body, specifically to the muscles that are working. the heart is not required to do this when at rest.

## ResultsPlus Examiner Comments

The response refers to the heart working harder to pump blood. This is insufficient to score the first point on the mark scheme - the idea of blood being pumped faster is needed. There is no mention of muscles requiring more oxygen or more respiration taking place, so overall, zero marks scored.

**5** (a) Explain why a person's heart rate increases when they are running compared with when they are at rest.

**(2)**

because while working at a high intensity the ~~muscles~~ muscles need oxygen to keep moving blood is pumped around the body much quicker to reach muscles faster

ResultsPlus
Examiner Comments

This response scores the first point on the mark scheme, for the comment about blood being pumped around the body quicker to reach muscles faster. If the candidate had stated muscles need more oxygen, then a second mark could be awarded.

**5** (a) Explain why a person's heart rate increases when they are running compared with when they are at rest.

**(2)**

Because ~~blood~~ more energy is required meaning that blood ~~becomes~~ is being pumped faster to carry oxygen for the person.

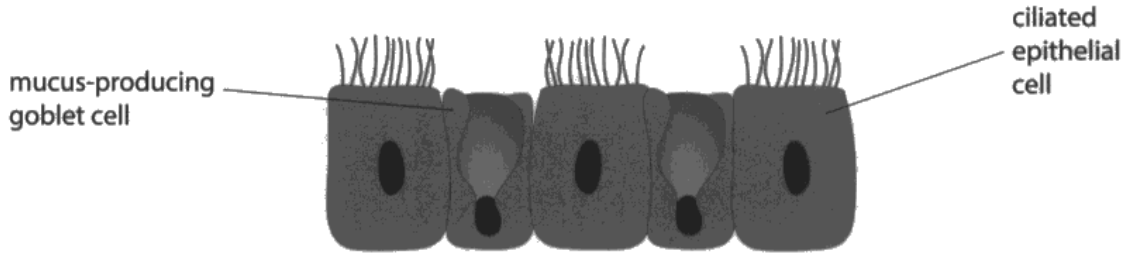
ResultsPlus
Examiner Comments

This answer scores two marks for 'more energy is required' and 'blood is being pumped faster'.

# Question 5(b)

In this question, candidates had to describe how pathogens are removed from the airways by ciliated epithelial cells. A diagram of cells in the airways of the lungs was provided for reference. A large proportion of candidates left this question blank. Cilia or hairs (on the ciliated epithelial cells) trapping pathogens was a common answer that was not credited. Few candidates realised that pathogens would get stuck in the mucus produced by goblet cells. Some candidates knew that cilia move pathogens or mucus to the throat; descriptions of going to the stomach or being coughed out were also credited.

(b) Figure 9 shows a diagram of mucus-producing goblet cells and ciliated epithelial cells in the airways of the lungs.




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

**Figure 9**

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

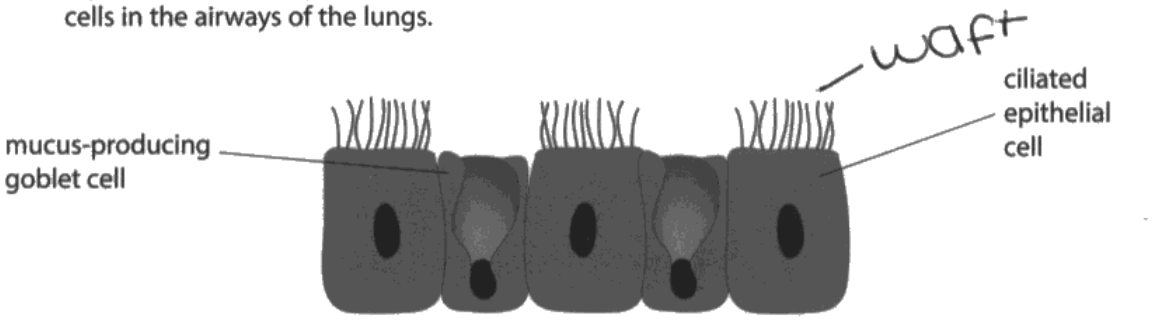
**(2)**

Because as the pathogens are going through the ciliated epithelial cell catches the pathogens and removes them.

ResultsPlus
Examiner Comments

This response scores zero marks. It shows misunderstanding of what happens to pathogens in the airways of the lungs. The description seems to imply that pathogens pass through ciliated epithelial cells and are trapped in the process.

(b) Figure 9 shows a diagram of mucus-producing goblet cells and ciliated epithelial cells in the airways of the lungs.




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

**Figure 9**

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

**(2)**

the cilia removes ~~pathog~~ pathogen by wafting its hair out of airways.
the movement of the hair excludes pathogens out.

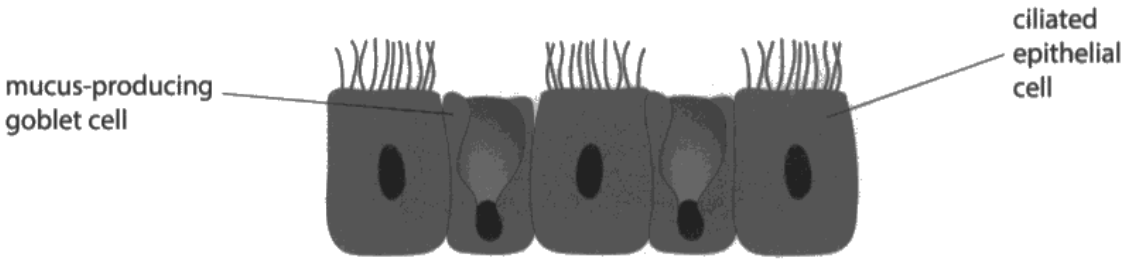
**ResultsPlus**
**Examiner Comments**

This response scores the second point on the mark scheme for the reference to cilia wafting pathogens. Airways is in the stem of the question, so 'out of airways' is insufficient to gain the third point on the mark scheme; there needs to be a comment about pathogens being moved to the throat or up the trachea.

**ResultsPlus**
**Examiner Tip**

Make sure that your revision includes how specialised cells are adapted to their function.

(b) Figure 9 shows a diagram of mucus-producing goblet cells and ciliated epithelial cells in the airways of the lungs.




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

**Figure 9**

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

**(2)**

Mucus traps pathogens, hairs on cilia move the mucus up the throat

ResultsPlus
Examiner Comments

This response scores two marks. Mucus trapping pathogens is the first point on the mark scheme and mucus moved up the throat is the third mark scheme point. 'Hairs on cilia' is a confused statement, but there is the implication that cilia are moving the mucus.

# Question 5(c)

Candidates wrote some very confused answers to this question that asked them to explain how aerobic respiration provides energy for running. Instead of focusing on what aerobic respiration involves, some candidates homed in on anaerobic respiration and they often wrote about muscle tiredness, lactic acid and cramp.

Straightforward answers that detailed the reactants and products of aerobic respiration invariably scored both marks. Correct equations also scored two marks. References to aerobic respiration being an exothermic reaction and that it takes place in mitochondria were also credited.

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

Figure 10 shows an athlete after a race.

(Source: © voronaman/Shutterstock)

**Figure 10**

Explain how aerobic respiration provides energy for running.

**(2)**

because the oxygen and glucose provides energy and then produces water and carbon dioxide

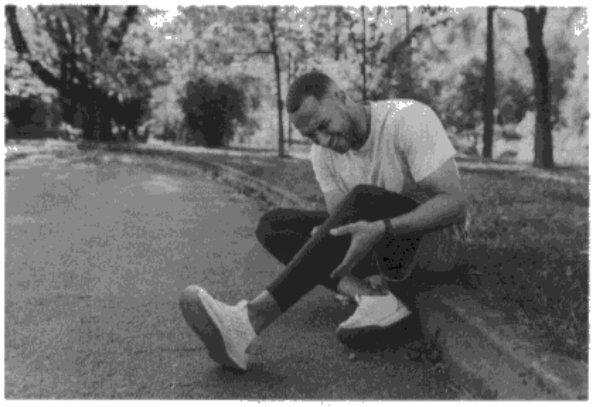
4

ResultsPlus
Examiner Comments

This response scores two marks. The candidate has described the reactants and products of respiration, so the first two points on the mark scheme can be credited. Correct equations also scored two marks.

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

Figure 10 shows an athlete after a race.



(Source: © voronaman/Shutterstock)

**Figure 10**

Explain how aerobic respiration provides energy for running.

**(2)**

aerobic respiration ~~be~~ takes place in mitochondria, which is where respiration occurs, and is an exothermic reaction, meaning it releases energy, so the runner can run.


This response scores two marks. It is a rarely seen answer that refers to aerobic respiration taking place in mitochondria and it being an exothermic reaction.

# Question 5(d)i-dii

In Q05(d)(i) relatively few candidates seemed to be familiar with rate of respiration investigations using the equipment shown in Figure 11. A large proportion of candidates did not know that soda lime is used to absorb carbon dioxide.

Q05(d)(ii) asked candidates to draw the new position of a drop of coloured liquid in the respirometer tube after five minutes. Most candidates could work out that the drop of coloured liquid moved 10 millimetres in five minutes, but it was surprising that many could not show this accurately on Figure 12. Arrows and lines pointing at 30 (millimetres) on the scale were accepted.

(d) The rate of respiration of maggots was investigated using the equipment shown in Figure 11.

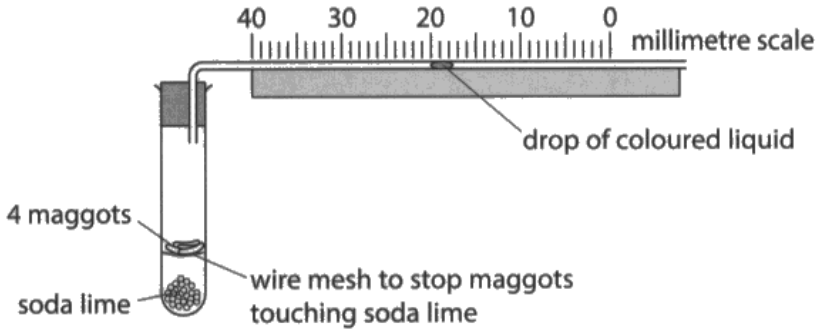



**Figure 11**

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

**(1)**

To test for Carbon dioxide

(ii) The drop of liquid in Figure 11 is at 20 mm.

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

Draw, on Figure 12, the new position of the bubble after the five minutes.

**(1)**

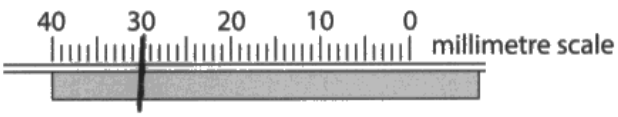



**Figure 12**

ResultsPlus
Examiner Comments

Q05(a)(i) Using soda lime to test for carbon dioxide is incorrect. Q05(a)(ii) A line drawn at 30 mm or an arrow pointing at 30 mm was accepted for the mark.

(d) The rate of respiration of maggots was investigated using the equipment shown in Figure 11.

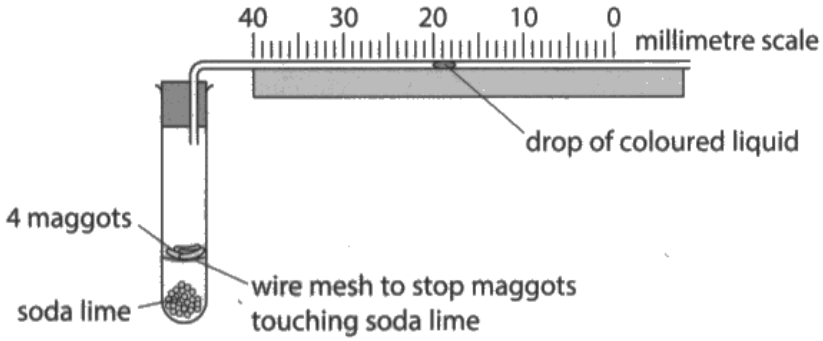



**Figure 11**

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

**(1)**

It collects carbon dioxide

(ii) The drop of liquid in Figure 11 is at 20 mm.

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

Draw, on Figure 12, the new position of the bubble after the five minutes.

**(1)**


**Figure 12**

ResultsPlus
Examiner Comments

This response scores two marks. Q05(a)(i) Collecting carbon dioxide was accepted for absorbs carbon dioxide. Q05(a)(ii) The drop of coloured liquid has been drawn in the correct position on Figure 12.

# Question 5(d)iii

It was pleasing that this question was well-answered by many candidates. They realised that with fewer maggots, the drop of coloured liquid in the tube would move slower and in many cases this was linked to fewer maggots respiring.

(iii) The investigation was repeated with two maggots.

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

**(2)**

The movement would be slower ~~with~~ with less noticable increases as there are less maggots ~~resp~~ respirating.

**ResultsPlus**
**Examiner Comments**

Slower movement of the drop of coloured liquid scores the first point on the mark scheme. Respirate is not an acceptable spelling of respire, so this response gains one mark.

**ResultsPlus**
**Examiner Tip**

Spend time learning how to spell important biological terms. Phonetic spellings are accepted for many words, but accurate spellings are always best.

(iii) The investigation was repeated with two maggots.

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

**(2)**

the coloured liquid would move less in the same time because the rate of respiration is lower.


This response shows good understanding of the investigation and scores full marks. The key points are conveyed very clearly.

# Question 5(d)iv

This was a straightforward question asking candidates to state one way that the rate of respiration investigation could be improved to obtain more reliable results. The majority of candidates gave the expected response of repeating the investigation, but some negated this statement by going on to say that the number of maggots should be changed.

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

**(1)**

repeat the experiment and add more maggots each time

ResultsPlus
Examiner Comments

Repeating on its own would score the mark, but adding more maggots each time negates this point. The number of maggots should be the same each time.

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

**(1)**

~~add a Stopwatch, add a or~~
do the experiment multiple times

ResultsPlus
Examiner Comments

This description of repeating the investigation scores the mark.

# Question 6(a)i

This question expected candidates to apply their knowledge of non-indigenous species that are indigenous to an area. Many responses stated that indigenous species are not native to an area, which is the opposite of the required answer. A large number of candidates also thought that indigenous species are poisonous or rare.

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

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

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

Two of these species were indigenous.

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

**(1)**

not native

ResultsPlus
Examiner Comments

This is the opposite of the expected response, so no credit given. Native species, species from the country of origin or species that naturally grow there were acceptable answers.

# Question 6(a)ii

Candidates who were familiar with ecological sampling techniques usually scored the mark for this question. Quadrat was the expected answer, but grid was accepted as was a square with some dimensions attributed to it. Candidates without the relevant knowledge gave answers such as spade or thermometer.

# Question 6(b)i

This was a very straightforward question, with the vast majority of candidates scoring the mark. A small proportion of candidates referred to the wrong species, so failed to gain any credit for their answer.

# Question 6(b)iii

Candidates found this question quite challenging. Simple answers such as 'the plants were bigger so they got more light' scored both marks, but such responses were not seen very frequently. However, many candidates scored one mark for comments such as reproduce more, take up more space, photosynthesise more. A small number of candidates confused plants with animals and wrote about predation.

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

**(2)**

It could have out-competed species B by eating its prey and leaving B with less food and therefore occupying the area.

**ResultsPlus**
**Examiner Comments**

This is not creditworthy response. There is confusion between plants and animals and the points stated are not relevant.

**ResultsPlus**
**Examiner Tip**

Always check that your answers fit in with the context of the question. This question is about one plant species out-competing another plant species. References to eating prey are not relevant.

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

**(2)**

One way ~~this~~ the species ~~B~~ could have outcompeted B is it could have absorbed all the minerals and water from the soil so species B didnt have enough to survive.

**ResultsPlus**
**Examiner Comments**

'Absorbed all the minerals and water' scores the second point on the mark scheme. There is nothing about the plant species being bigger, or taller, or having larger roots, so this response is awarded one mark.

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

**(2)**

By being bigger it would be able to take in more nutrients and light

ResultsPlus
Examiner Comments

This response scores two marks. 'Being bigger' scores one mark and 'take in more nutrients and light' gains a second mark.

# Question 6(b)iv

A large number of candidates wrote that the species H was planted in the area by humans. These answers were not credited because the question stated that a wall was built around the area to keep humans out. Most of the responses that scored the mark referred to wind or animals bringing in seeds.

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

**(1)**

Could have been imported in by humans.

ResultsPlus
Examiner Comments

Comments about humans planting species H or bringing it into the area, were not credited.

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

(1)

Birds carrying the seeds and dropping them into the area.

ResultsPlus
Examiner Comments

The most common creditworthy answers include references to birds dropping seeds and the wind blowing seeds into the area. This response scored one mark.

# Question 6(c)

This extended open response question asked candidates to devise a plan to estimate the number of named plant species growing in a field. Candidates who were familiar with fieldwork fared much better than those who clearly had no experience of ecological sampling techniques. To score a mark in level 1, using a grid or quadrat then counting the plants within it was all that was required. A little more detail about the method was required to move into level 2, such as giving the dimensions of the quadrat or repeating the sampling procedure. A mark at the top of level 2 was awarded if there was a general idea of how to scale up the number of plants in the sample for the whole field. Level 3 required a workable plan that included random sampling. It was pleasing to note that a large number of candidates knew how random sampling could be achieved. A mark at the top of level 3 was awarded if there was an accurate description of scaling up numbers for the whole field. For example, averaging the number of plant species per quadrat of known area, then scaling this up for the area of the whole field.

*(c) Figure 14 shows some plants growing in a small area of a 1000 $m^2$ field.


**Figure 14**

Devise a plan to estimate the number of named plant species growing in this field.

(6)

Firstly count how many plant species that are growing in the field. After you have counted how many plant species are in the area you ~~the~~ can ~~can~~ then times it by how big the field is.

ResultsPlus
Examiner Comments

Counting the plant species in the area is one relevant part of a plan, which puts the response into level 1. There is some additional detail about multiplying up the numbers for the whole field, so this puts the response at the top of level 1. To get into level 2 the plan needs to be more detailed, such as using a quadrat in different areas of the field and counting how many of each plant there are in the quadrat.

ResultsPlus
Examiner Tip

Remember that you may be asked to recall and apply your knowledge and understanding of core practicals in different types of question. Learning the basic details of these practicals should be an important part of your revision.

*(c) Figure 14 shows some plants growing in a small area of a 1000 m² field.


**Figure 14**

Devise a plan to estimate the number of named plant species growing in this field.

(6)

- Take a 'square grid' with an even length on both sides.
- place the grid with a evenly spaced out from each recording
- record the number of species found
- do this multiple times
- work out average for each species
- start this process from near the roots/stump of the tree and work your way towards the most grassy area.

Control Variables: - same size square for each location
- same distance from the recent plot of the grid.

ResultsPlus
Examiner Comments

Using a 'square grid' and recording the number of species found gives an idea of sampling. This puts the response at the top of level 1. Doing this multiple times is additional detail that put the response into level 2. Although the candidate states that an average should be calculated, there is no mention of how the results could be scaled up for the whole field. Therefore, this response stays at the bottom of level 2 (three marks). For level 3 the plan should include some detail about random sampling.

*(c) Figure 14 shows some plants growing in a small area of a 1000 m² field.


**Figure 14**

Devise a plan to estimate the number of named plant species growing in this field.

**(6)**

* Pupils should use a quadrat to work out the plant species
* They should take multiple readings to workout overall estimate
* Throw the quadrat and count the number of plants within the quadrat.
* Multiply the number, then the area of feild divided by area of the quadrat.
* This will give an estimate to the total number of species in the field.

* number of species = number of plants × area of field / area of quadrat.

## ResultsPlus Examiner Comments

Using a quadrat and counting the number of plants within it puts the response at the top of level 1 as this is two parts of a plan. Taking multiple readings is extra detail that moves the response into level 2. There is a good description of scaling up the number of plants for the whole field, which puts the response at the top of level 2. This is not a level 3 response since there is no detail about random sampling. Without any supporting information, just throwing the quadrat is insufficient at this level.

*(c) Figure 14 shows some plants growing in a small area of a 1000 m² field.


**Figure 14**

Devise a plan to estimate the number of named plant species growing in this field.

**(6)**

- Stand in the field and throw 5 quadrats randomly (100cm x 100cm)
- Count how many dandelions, hawkbits, clovers and plantains there are inside the quadrats (All five)
- Measure the ~~surface~~ area of the field
- ~~divide the size of~~ times the number of species by how much bigger the field is compared to the quadrat (and how many of each species there are)

ResultsPlus
Examiner Comments

Although quite brief, there is just sufficient detail about the method to put this response into level 3. The reference to throwing quadrats randomly is the key point that moves the response from level 2 to level 3. Since there is no clear explanation of how to estimate the number of plants in the whole field, this answer scores five marks, not six.

*(c) Figure 14 shows some plants growing in a small area of a 1000 $m^2$ field.


**Figure 14**

Devise a plan to estimate the number of named plant species growing in this field.

**(6)**

~~Measure area of Quad~~

Place Quadrat around the field in random positions 4-5 times

Count number of plants inside each quadrat

Find the average number of each plant

~~X~~ 1000$m^2$ field ÷ area of quadrat = Multiplier

Multiplier x Average number of plants


Although this response is brief, it is well-structured. The first four lines are enough to put the answer into level 3. There is a workable plan with random sampling and repeats. The reference to averaging and using a multiplier is very clear and puts the response at the top of level 3.

# Paper Summary

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

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

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