



# **Examiners' Report June 2022**

**GCSE Biology 1BI0 2H**

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## Introduction

The Pearson Edexcel GCSE (9-1) Paper 2 Biology (Higher tier) paper is the second of two papers taken as part of the GCSE (9-1) Biology qualification. This is the fifth assessment of the GCSE (9-1) Biology specification, and the qualification follows a linear assessment model whereby candidates must complete the two papers in the same single year of certification.

Paper 2: Biology (Higher tier) is awarded a total of 100 marks and it is assessed by a variety of question types, including multiple-choice questions, short answer questions, calculations and extended open response questions. Candidates should answer all questions in a time period of 1 hour and 45 minutes. The extended open response questions are 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) Biology qualification assesses practical knowledge and maths skills; the requirements of which are given in the specification. Furthermore, there are 8 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.

Paper 2: Biology (Higher tier) contains questions assessing the content from topics 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 the movement of substances through plants, the structure and function of the heart and blood vessels, feeding relationships, the role of bacteria in the nitrogen cycle, hormones including adrenalin, thyroxine and the hormones of the menstrual cycle, the use of plant hormones, conservation and reforestation and Fick's law.

Questions designed to assess practical work included writing a plan to determine measuring the best material for use in a T-shirt, the core practical task of transpiration in plants, and applied knowledge including an understanding of the need to control variables and how to set up a control. In addition to this, food testing was also assessed in a multiple-choice question. The maths skills assessment in this paper related to questions requiring rate calculations, unit conversions, percentages and applying skills using a given equation to calculate capture and recapture data.

## Question 1 (a)(ii)

Most candidates were able to identify that more haemoglobin meant more oxygen, so most candidates were able to get the mark for this, although few candidates referred to oxygen binding to haemoglobin. Where candidates went wrong was stating that high levels of haemoglobin meant that it could fight off diseases or that they take in less polluted water.

(ii) Bloodworms have a high level of haemoglobin in their blood.

Give a reason why this helps them survive in polluted water.

(1)

There is low levels of oxygen in the polluted water  
So they need as much haemoglobin as possible to bond with what little oxygen there is



This answer is stating that more oxygen is needed and haemoglobin facilitates this for 1 mark.

(ii) Bloodworms have a high level of haemoglobin in their blood.

Give a reason why this helps them survive in polluted water.

(1)

haemoglobin carries blood so if it has high levels,  
it can carry lots of oxygen at ~~one~~ time.



This is 1 mark, the idea that lots of oxygen can be carried is fine for the mark.

### Question 1 (a)(iii)

Most candidates scored on both marking points. The most common issue was the omission of "concentration gradient" with reference instead to "concentration difference" or just "concentration". Temperature was a common suggestion.

(iii) Carbon dioxide diffuses from the body of the bloodworm into the water.

Give **two** factors that affect the rate of diffusion.

(2)

1 The temperature of the water

2 levels of carbon dioxide. ~~and oxygen~~



Just 1 mark awarded here for the temperature of the water as seen in the additional guidance as an accept.

LOW oxygen levels in the bloodworms will <sup>survive due to</sup> ~~kill~~ them.  
(iii) Carbon dioxide diffuses from the body of the bloodworm into the water.  
\* Give **two** factors that affect the rate of diffusion. <sup>high haemoglobin levels. (2)</sup>

1 temperature

2 carbon dioxide concentration of the water.

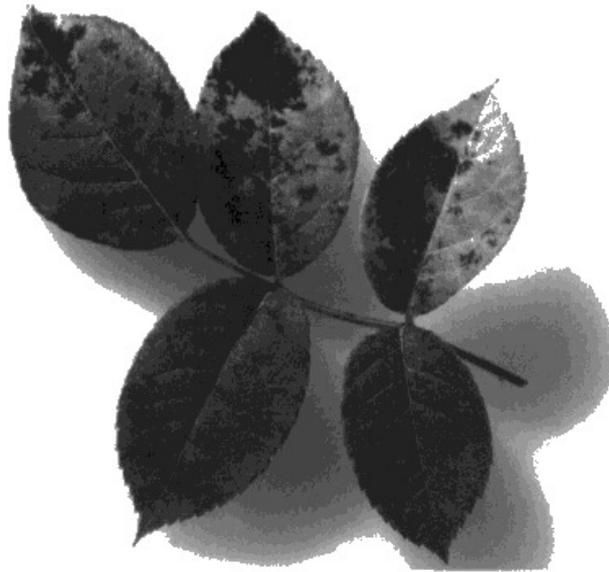


Temperature is acceptable for 1 mark, this is shown in the additional guidance. Carbon dioxide concentration is not enough for a mark as it must be concentration gradient.

## Question 1 (b)

Most candidates do not understand the role of the use of blackspot fungus as an indicator species. Many candidates made the conclusion that the air was polluted as the plant was diseased, with many linking the poor air quality to an excess of  $\text{CO}_2$  being present inhibiting photosynthesis.

(b) Figure 1 shows part of a diseased rose plant from a garden.



(Source: © Manfred Ruckzio/Shutterstock)

**Figure 1**

Explain what Figure 1 indicates about the air quality in the garden.

(2)

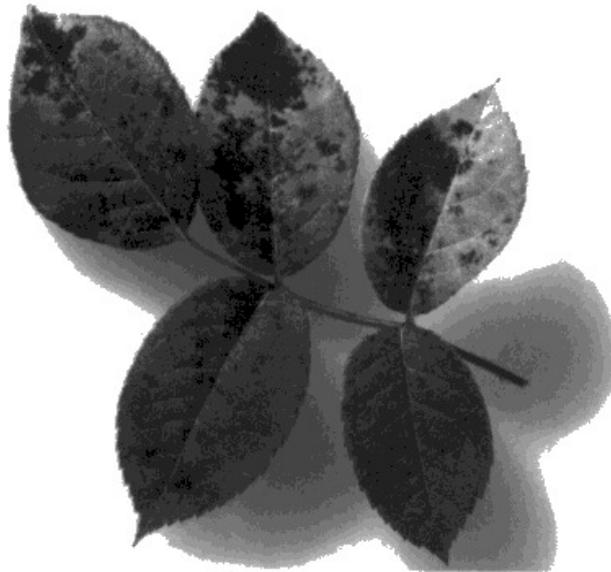
This indicates that there is a good air quality in the garden because black spots (the disease on the rose) can only ~~go to~~ grow without the presence of sulfur dioxide meaning there is less air pollution so better quality.

**(Total for Question 1 = 6 marks)**



This candidate has correctly identified that the air is clean for a mark. They have not correctly identified black spot fungus so the second mark cannot be awarded.

(b) Figure 1 shows part of a diseased rose plant from a garden.



(Source: © Manfred Ruckszio/Shutterstock)

**Figure 1**

Explain what Figure 1 indicates about the air quality in the garden.

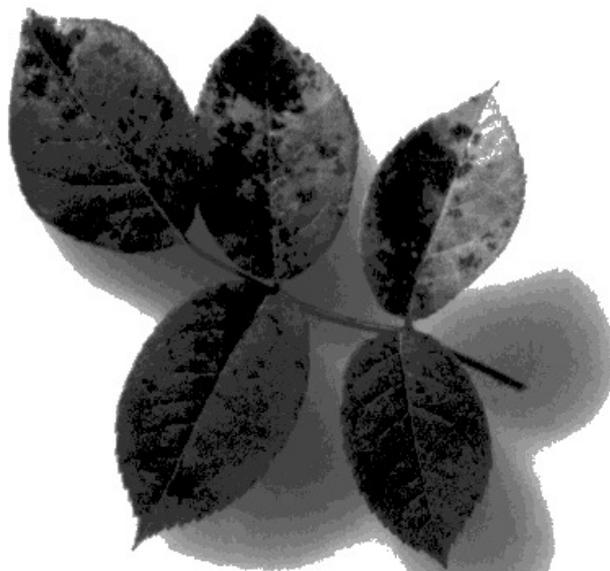
(2)

The air ~~is~~ is very polluted with sulfur dioxide, so black spot fungus so black spot fungus will grow on the roses.



They have recognised that black spot fungus is present for the first marking point, but they have not linked it to clean air.

(b) Figure 1 shows part of a diseased rose plant from a garden.



(Source: © Manfred Ruckszio/Shutterstock)

**Figure 1**

Explain what Figure 1 indicates about the air quality in the garden.

(2)

the air is polluted as the leaves have dark spots  
and have been infected as the leaves took in the  
polluted gases during gas exchange.



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Examiner Comments

This candidate refers to black spots being present but this is not enough for the first marking point. They incorrectly link this to high levels of pollution. 0 marks awarded.

## Question 2 (a)(ii)

Most candidates were able to recognise the structures in the xylem including thick cell walls and a long continuous tube. There was some mention of lignin and the fact that the cells making up the xylem were dead cells.

(ii) Describe **two** features of the structure of xylem vessels that can be seen in Figure 2.

(2)

1. Lignin is deposited, this gives the xylem a ~~rigid~~ structure ~~and~~ hollow tube.
2. ~~Lignin also~~ Since there are dead cells in xylem the water and mineral ions travel in one direction only from roots to shoot.



Note although this candidate has gained 2 marks on the first point this is fine as we have no rejects against these marking points. 1 mark for lignin and 1 mark for hollow tube, dead cells again is the same mark as the lignin mark.

(ii) Describe **two** features of the structure of xylem vessels that can be seen in Figure 2.

(2)

1. thick cell walls
2. only travels one direction



Thick cells walls is fine for thick walls for the first marking point. Only travels in one direction is not acceptable for the mark as it is not a structural feature of the xylem. 1 mark awarded.

## Question 2 (b)(i)

Generally this question was well answered by most candidates for 2/3 marks. They were able to correctly link the idea that increased airflow caused water to move away from the leaf thus increasing the concentration gradient, so more water was taken up by the plant.

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

(3)

• The wind moves the water off the leaf. The stomata opens up more. goes into atmosphere.



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Examiner Comments

The wind moves water off the leaf is acceptable against MP1 and MP2 for the idea of air flow and the removal of water from the leaf. 2 marks awarded.

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

(3)

The volume of water increased as more water was being blown away and lost via the stomata. The water level increased to remain at homeostasis, and to be able to continue carrying out photosynthesis.



The idea of water being blown away is enough for the idea of increased air flow for the first marking point. Water moved away via the stomata is enough for the second marking point. The water level increased is acceptable for the last marking point as this is implied by the question. 3 marks awarded.

## Question 2 (b)(ii)

This question was mostly answered correctly, most common responses were as a comparison or to show a difference or as a control – there was little confusion with control variables.

- (ii) Give **one** reason why the volume of water taken up by the plant was also measured when the fan was not switched on.

(1)

*it presents a baseline result so that the difference between the fan on and off results can be calculated.*



A baseline result is fine for this mark. This could also be given for the idea that there is a difference between the two measurements which is enough for the comparative. 1 mark awarded.

- (ii) Give **one** reason why the volume of water taken up by the plant was also measured when the fan was not switched on.

(1)

*As the scientists are trying to see how much the volume of water taken changes with air, therefore they can compare it.*



The idea that they can compare it is enough for this mark.

## Question 2 (b)(iii)

A significant number of candidates struggled with finding the correct values from the graph and/or omitted to then divide by 2.

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

Use the equation

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

(2)

$$68 - 52 = 16 \\ \frac{16}{2} = 8$$

.....2..... mm<sup>3</sup> per minute



This candidate has completed the first part of the calculation correctly and it is shown so we can give MP1. Although they have then divided correctly by 2 to get 8, they have put 2 on the answer line so only 1 mark can be awarded.

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

Use the equation

$$\text{rate of water uptake} = \frac{\text{volume of water taken up}}{\text{time taken}} \quad (2)$$

$$\text{rate} = \frac{68 - 52}{2}$$
$$\text{rate} = 8 \text{ mm}^3 / \text{minute}$$

.....8..... mm<sup>3</sup> per minute



This is the most common answer and is awarded full marks.

### Question 3 (a)(i)

It was well understood that the artery wall was in general thicker than the wall of the vein but the reasons for this were less well understood. Linking this to higher blood pressure in the artery was seen less often.

3 (a) Figure 4 shows a cross-section of an artery and a vein.



(Source: © The University of Kansas Medical Center)

**Figure 4**

(i) Explain **one** difference between the artery wall and the vein wall shown in Figure 4.

(2)

The vein has a thin wall whereas the artery has a thick wall which is made of muscle which is elastic.



We can accept thick wall as long as it is qualified by vein has a thin wall which is a comparative. 1 mark awarded here.

3 (a) Figure 4 shows a cross-section of an artery and a vein.



(Source: © The University of Kansas Medical Center)

**Figure 4**

(i) Explain **one** difference between the artery wall and the vein wall shown in Figure 4.

(2)

The ~~vein~~ artery wall is thicker as it carries more blood at a higher pressure which the thick walls help it to withstand.

The vein wall is thinner as it carries less blood and <sup>so</sup> has to withstand a lower pressure.



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Examiner Comments

The artery wall is thicker and carries blood at a higher pressure is 2 marks.



Remember if you are asked to compare two things then words with 'er' at the end are the best to use, eg 'thicker', 'larger' etc.

3 (a) Figure 4 shows a cross-section of an artery and a vein.



(Source: © The University of Kansas Medical Center)

**Figure 4**

(i) Explain **one** difference between the artery wall and the vein wall shown in Figure 4.

The vein wall is much thinner as it allows more blood to flow through. (2)  
The artery is much thicker to deal with the larger circulation of blood without breaking.



We can accept the reverse argument here against MP1, the vein is much thinner can be awarded the mark. Larger concentration of blood without breaking is incorrect science and is not acceptable for higher pressure. We could accept prevent the artery from breaking/bursting for the second marking point. Only 1 mark awarded here.

### **Question 3 (a)(ii)**

It was surprising to note that very few candidates were able to identify structures found in veins as valves.

### **Question 3 (b)(i)**

A number of candidates seemed to struggle with the mathematics here, but most managed to pick up one mark often for the division by 2. The majority of candidates were able to score full marks on this question.

### Question 3 (b)(ii)

Most candidates were able to link the increase in blood flow as being needed for respiration but only a few were able to say that therefore they needed increased oxygen and glucose so respiration could increase during exercise. They only need to refer to the increased need once in their answer in order for this to be credited.

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

(2)

Muscles need oxygen and glucose to exercise, meaning the direction of blood flow to the muscles increases because they are in need of a high supply of oxygen and glucose.



Just 1 mark awarded here for a high supply of oxygen/glucose needed is sufficient for more oxygen/glucose.

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

(2)

Red blood cells carry oxygen in the form of oxyhaemoglobin. During exercise, there is an increased rate of respiration so an increased blood flow is needed to take more oxygen in the cells to respire and make more energy.



Both marks can be awarded here for increased respiration and more oxygen.

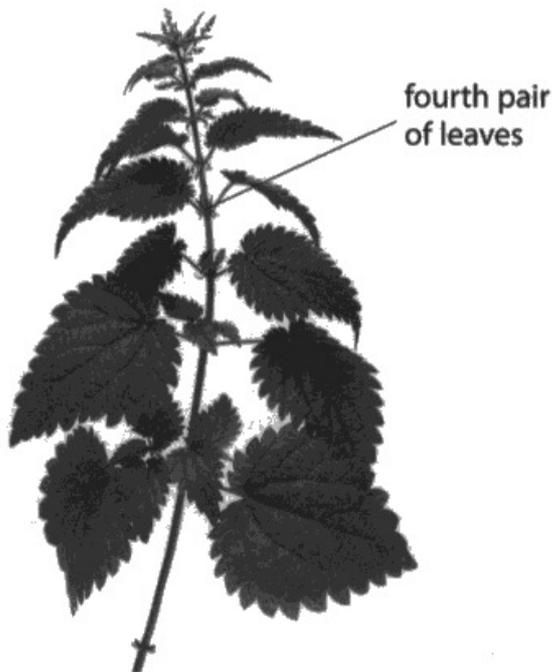
## Question 4 (a)

The overwhelming majority of candidates scored the mark on this question, often by stating the idea of a control variable (there was little confusion with the idea of a control and there were very few references to the idea of validity. Common errors made were references to ensuring leaves of the same size or stating it was done to ensure a reliable or fair test. Fair testing is something from Key stage 2 which should not be an answer on a GCSE paper.

- 4 A student investigated the width of leaves on nettle plants growing in two areas next to a woodland.

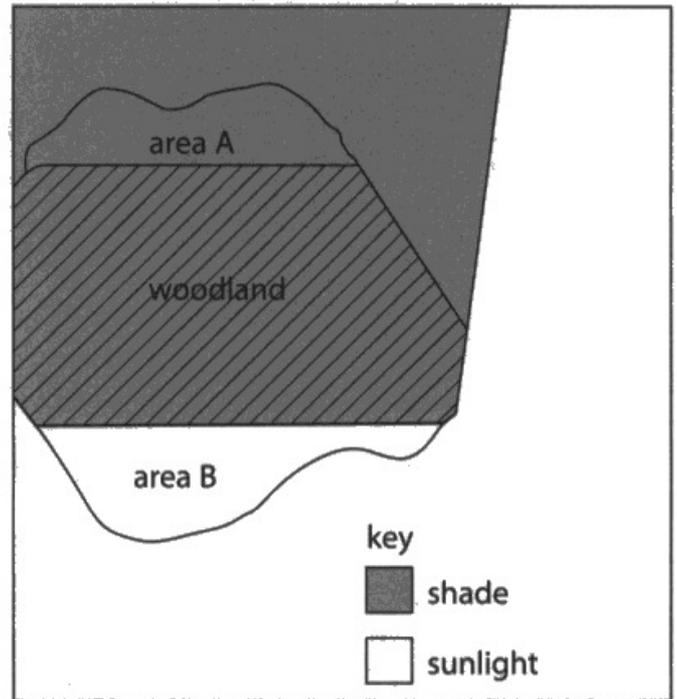
Figure 5a shows a nettle plant and Figure 5b shows a map of the woodland showing area A and area B.

The woodland caused area A to be in the shade.



(Source: © Alila Medical Media/Shutterstock)

**Figure 5a**



**Figure 5b**

The student measured the maximum width of leaves on five plants from each area.

The student always measured one leaf from the fourth pair of leaves.

- (a) Give **one** reason why the student always measured a leaf from the fourth pair of leaves.

(1)

The student always measured a leaf from the fourth pair because then they could see if there is any differences between that pair of leaves and any others.

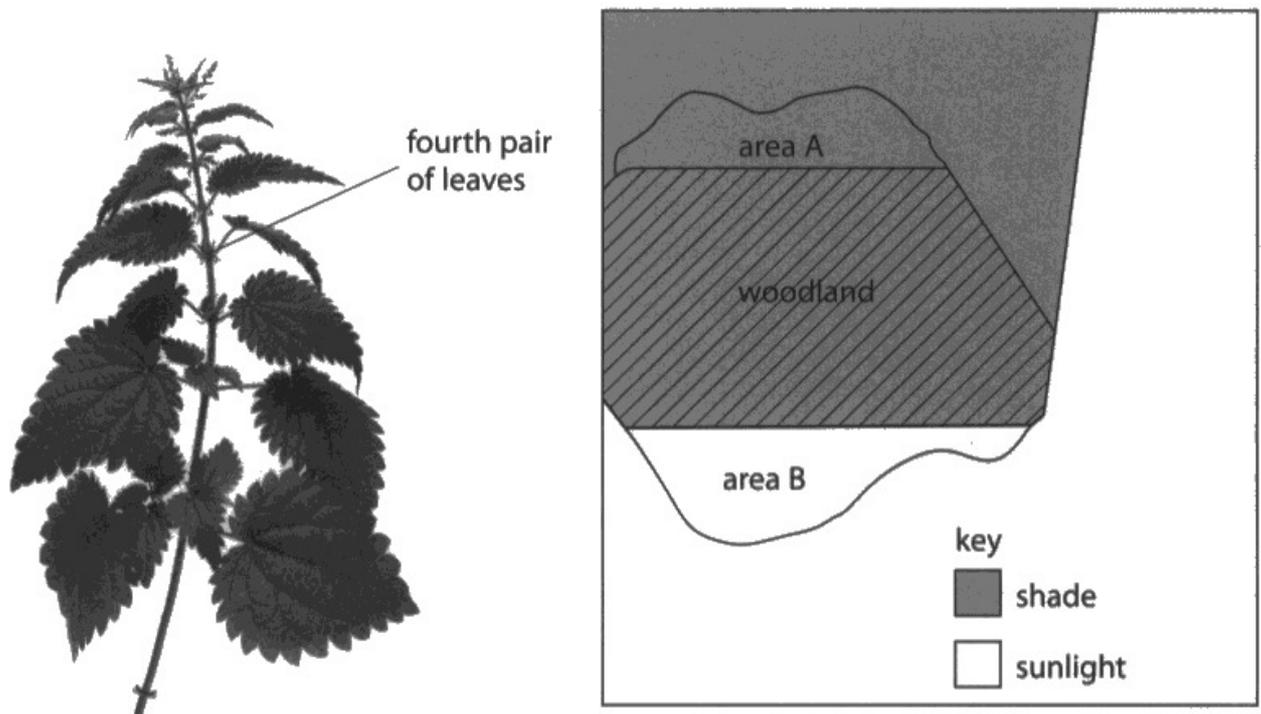


Candidates have to make some comment about the leaves being the same size, shape etc. No marks awarded.

- 4 A student investigated the width of leaves on nettle plants growing in two areas next to a woodland.

Figure 5a shows a nettle plant and Figure 5b shows a map of the woodland showing area A and area B.

The woodland caused area A to be in the shade.



(Source: © Allila Medical Media/Shutterstock)

**Figure 5a**

**Figure 5b**

The student measured the maximum width of leaves on five plants from each area.

The student always measured one leaf from the fourth pair of leaves.

- (a) Give **one** reason why the student always measured a leaf from the fourth pair of leaves.

(1)

To see the change in growth between the sets of leaves.

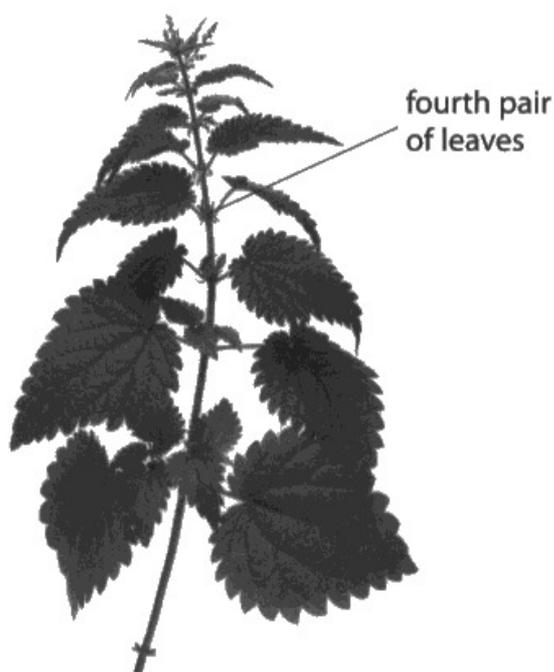


This response is not enough for the mark, candidates must refer to something about the leaves or comparing the results etc.

- 4 A student investigated the width of leaves on nettle plants growing in two areas next to a woodland.

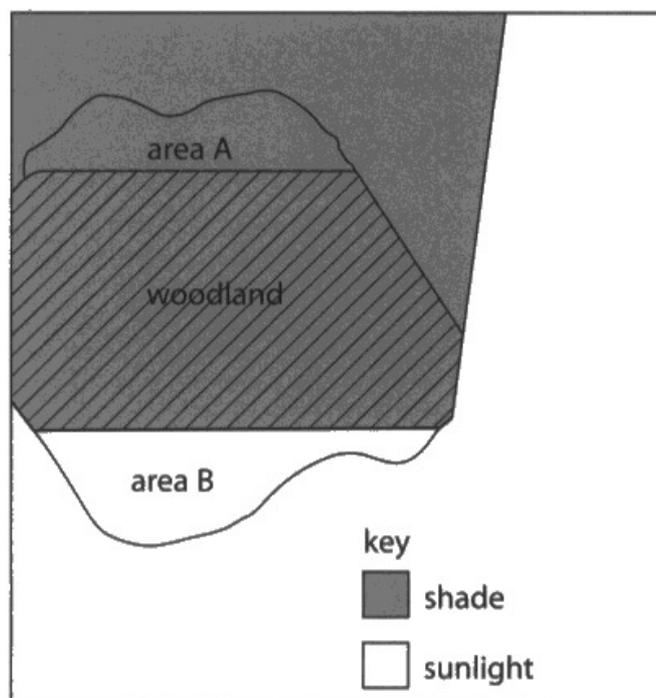
Figure 5a shows a nettle plant and Figure 5b shows a map of the woodland showing area A and area B.

The woodland caused area A to be in the shade.



(Source: © Allila Medical Media/Shutterstock)

**Figure 5a**



**Figure 5b**

The student measured the maximum width of leaves on five plants from each area.

The student always measured one leaf from the fourth pair of leaves.

- (a) Give **one** reason why the student always measured a leaf from the fourth pair of leaves.

(1)

Because it makes the experiment fair, as they are all being measured by the same part of the plant.



The same part of the plant is not sufficient for the mark.

## Question 4 (b)(ii)

Most candidates were able to state the leaves in the shade were wider but the lack of knowledge as to why was significant – candidates were, in the main, unable to correctly give the reason for the wider leaves. The weakest responses gave some incorrect explanations that ranged from unable to absorb nutrients from the soil to the nettles growing better in shaded areas. Candidates who did score both MPs mostly did so by relating the larger width to absorbing more sunlight and not to a higher surface area.

(ii) Explain the difference in the mean width of leaves in the shade and those in the sunlight.

(2)

the leaves which were in the shade were  
consistently smaller than the ones which were  
in the sun. they had less energy so didnt grow but the  
ones in the sun had plenty food energy and grew larger

11



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Examiner Comments

This candidate is saying the leaves in the shade were smaller when they were actually larger so no marks can be awarded as they have incorrectly analysed the data.

(ii) Explain the difference in the mean width of leaves in the shade and those in the sunlight.

(2)

The leaves in ~~area~~ <sup>the shade</sup> have a greater mean width to increase the amount of photosynthesis. The leaves in the sunlight have a smaller mean width because they can already photosynthesise very well and they receive lots of sunlight than the leaves in the shaded area don't



**ResultsPlus**  
Examiner Comments

Greater mean width in leaves is enough for 1 mark, the second mark needs to link this to absorbing more light or having a larger surface area.

### Question 4 (c)(i)

This drawing of an accurate food chain linking the five organisms proved to be a problem for many candidates. Several candidates are still putting in arrows indicating which organism eats another rather than the direction of energy flow. In addition to this, many candidates drew energy pyramids or did not indicate energy flow at all and just gave a list.

(c) The student also studied some of the animals in areas A and B.

The student saw caterpillars eating the leaves of some nettles.

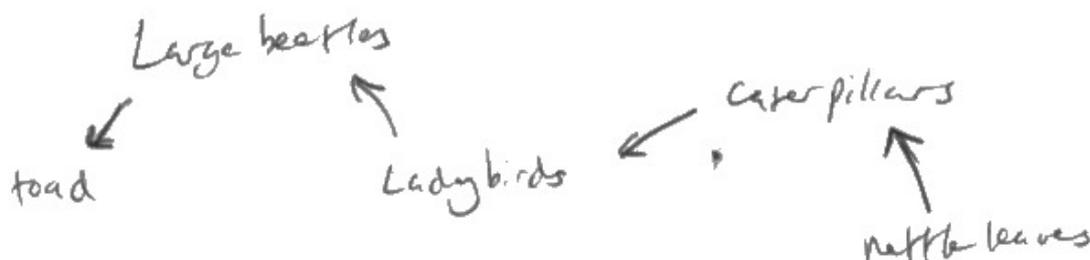
The student also saw a toad eating a large beetle.

Large beetles eat ladybirds.

Ladybirds eat caterpillars.

(i) Give the food chain for these feeding relationships.

(3)



This candidate has written the food chain correctly just right to left. The arrows are in the correct places going from nettles to toad so all three marks can be awarded.

(c) The student also studied some of the animals in areas A and B.

The student saw caterpillars eating the leaves of some nettles.

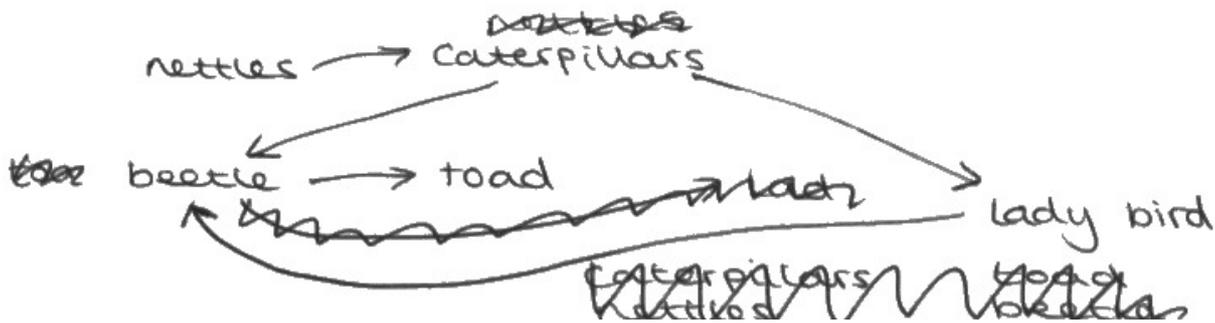
The student also saw a toad eating a large beetle.

Large beetles eat ladybirds.

Ladybirds eat caterpillars.

(i) Give the food chain for these feeding relationships.

(3)



Although this candidate has added in extra lines, they have at least 2 correct linkages so can be awarded 2 marks.

(c) The student also studied some of the animals in areas A and B.

The student saw caterpillars eating the leaves of some nettles. ~~x~~

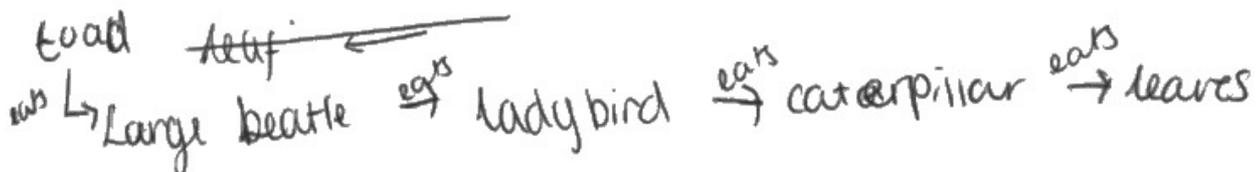
The student also saw a toad eating a large beetle. ~~x~~

Large beetles eat ladybirds. ~~x~~

Ladybirds eat caterpillars. ~~x~~

(i) Give the food chain for these feeding relationships.

(3)





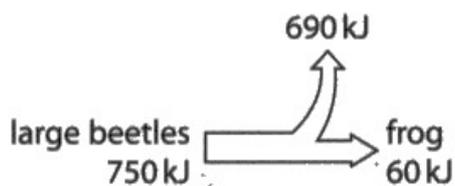
This candidate has put the organisms in the correct order BUT the arrows are the wrong way around so they can ONLY be awarded 1 mark.

### Question 4 (c)(ii)

Most candidates were able to complete the mathematical calculation effectively and scored full marks on this question.

(ii) Frogs also eat large beetles.

Figure 7 shows the energy transferred between these animals.



**Figure 7**

Calculate the percentage efficiency of energy transfer from the large beetles to the frog.

$$\frac{60}{750} \times 100 = 8\% \quad (2)$$

.....8.....%



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Examiner Comments

8% on the answer line is 2 marks

### Question 4 (c)(iii)

There was some confusion here as to how energy is transferred, with candidates often stating it was lost to the environment when they needed to state how this energy was transferred either by movement/respiration etc. Some candidates referred to not all the beetles being able to be digested or not all of the beetles being able to be eaten, both of which were creditable.

(iii) Give **two** reasons why only some of the energy in the biomass of the large beetles is transferred to the biomass of the frog.

(2)

1 waste energy

2 Only 75 kJ of transferrable energy



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Examiner Comments

This candidate has referred to waste energy but not how this energy was used so no marks can be awarded.

(iii) Give **two** reasons why only some of the energy in the biomass of the large beetles is transferred to the biomass of the frog.

(2)

1 most is transferred to the surroundings

2 ~~be~~ The frog secretes a lot of the  
on large beetles.



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Examiner Comments

Most is transferred to the surroundings is not enough for the mark, we need to know most of the energy and also in what form for the mark. The frog secretes beetles is not a mark. 0 marks awarded.

(iii) Give **two** reasons why only some of the energy in the biomass of the large beetles is transferred to the biomass of the frog.

(2)

1. Because the energy is transferred into heat energy.
2. The energy could also be transferred into kinetic energy.



For the heat mark it must be transferred to the surroundings/environment not just heat transferred or lost. Kinetic energy is the equivalent to movement energy for 1 mark.

### **Question 5 (a)(ii)**

This was a simple conversion calculation which required candidates to multiply by 1000 to convert millimetres into micrometres. Many candidates divided by 1000 instead thus losing the mark.

### Question 5 (b)(i)

Most candidates answered the first part of the question correctly, identifying X, but often stated nitrogen-fixing bacteria or de-nitrifying bacteria for Y in the second part.

(b) Figure 9 shows part of the nitrogen cycle.



**Figure 9**

(i) Identify the types of microorganism involved in process X and process Y.

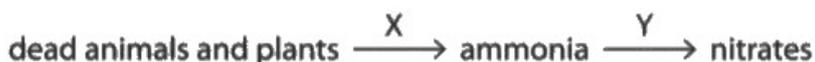
(2)

x decomposers  
y nitrogen fixing bacteria



Decomposers is the first mark point. Reject nitrogen fixing bacteria as it needs to be nitrifying bacteria for the second mark. 1 mark awarded.

(b) Figure 9 shows part of the nitrogen cycle.



**Figure 9**

(i) Identify the types of microorganism involved in process X and process Y.

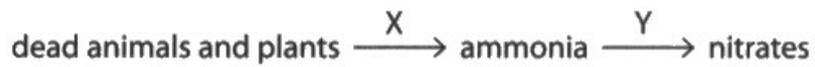
(2)

x fungi  
y bacteria



Fungi is in the additional guidance column as an accept for 1 mark. Nothing for bacteria on its own. 1 mark awarded.

(b) Figure 9 shows part of the nitrogen cycle.



**Figure 9**

(i) Identify the types of microorganism involved in process X and process Y.

(2)

X decomposers  
Y nitrifying



Decomposers 1 mark. Nitrifying is close enough to nitrifying for the second mark. 2 marks awarded.

## Question 5 (b)(ii)

Many candidates did not have any understanding of crop rotation. Many candidates discussed leaving fields empty to replenish for a season or discussed the importance of letting a field's nutrients regenerate. Of those that did have some idea, there was confusion about the process by which legumes used nitrogen-fixing bacteria, confusion with de-nitrifying bacteria, or the process by which fixed nitrogen was accessible to the soil.

(ii) Explain how crop rotation increases nitrate levels in the soil.

(3)

Crop rotation involves growing leguminous plants in an area or field. These plants have a mutualistic relationship with Nitrogen fixing bacteria which aids the production of Nitrogen compounds then converted into nitrates. This increases levels of nitrates in the soil, nitrates are the primary structure needed to create proteins, thus important for growth. Then when you rotate the crop and grow a non-leguminous plant on the soil will be fertile.



1 mark for leguminous crops. The second mark for nitrogen fixing bacteria. 2 marks awarded.

(ii) Explain how crop rotation increases nitrate levels in the soil.

(3)

a farmer could plant his normal crops, once the crop is fully grown the levels ~~of~~ <sup>of</sup> nitrates in the soil decrease. The farmer could then rotate to nitrate-fixing crops such as peas and beans. These plants contain bacterium in their roots which convert nitrogen into nitrates. This will allow for an increase in nitrates in the soil. By repeating crop rotation, we will obtain a good nitrate level.



3 marks awarded. 1 mark for named leguminous plants – peas. 1 mark for happening in the roots (roots is acceptable for root nodules), 1 mark for bacteria that convert nitrogen to nitrates as it is equivalent to nitrogen fixing bacteria.

(ii) Explain how crop rotation increases nitrate levels in the soil.

(3)

Crop rotation is when different types of crops are planted on rotation during the year. It increases nitrate levels in the soil because it allows nitrates to be absorbed again by the soil <sup>as it is not being used up by plants.</sup> This needs to happen because otherwise the nitrate levels in the soil would decrease eventually causing the crops to die.



No marks for nitrate levels increase as this is in the question.



Make sure you read the whole question as there may be information at the start of a question that can inform later answers.

## Question 5 (b)(iii)

Most candidates were able to gain MP1 for identifying that the crops would grow more, but a significantly reduced number were then able to identify that the nitrates produced proteins or amino acids for the growth, with many candidates opting instead to explain how improved growth would improve crop yields which is a repeat of the question.

(iii) Explain why increased nitrate levels in the soil improve crop yield.

(2)

Nitrate levels <sup>improves</sup> ~~increase~~ ~~from~~ the crop yield as it ~~encourages~~ nitrate encourages plants to grow, meaning they are more likely to grow, this improves the amount of crops grown and therefore the crop yield.



**ResultsPlus**  
Examiner Comments

Just 1 mark awarded for growth. This is the most common mark point for this question.



**ResultsPlus**  
Examiner Tip

Look to the number of marks awarded for the question to see how many points need to be made.

(iii) Explain why increased nitrate levels in the soil improve crop yield.

(2)

Crops can absorb nitrates, which are mineral ions to make proteins that the crop can use for growth. Thus, crops grow better and bigger, increasing the crop yield.



2 marks awarded. Mineral ions needed to make protein for 1 mark, used for growth is the second marking point.

## Question 6 (a)(i)

Most candidates scored both MPs on this question, the candidates could correctly link oestrogen and progesterone to the suppression of LH and FSH. If they identified these two hormones, then it was unusual for the candidate to then not score MP2, although there was often lack of clarity about the precise relationship between oestrogen/progesterone, LH/FSH and follicle development/ovulation. A significant number of candidates only considered the consequences of increased levels of oestrogen and progesterone and if this was the case then they rarely scored as they linked this to the thickening of the uterus lining or to inhibition of a menstrual period. A number of candidates scored two marks for linking the thicker cervical mucus to blockage of sperm, the alternative of thinning uterus lining and preventing implantation was seen comparatively rarely – where these alternative responses were seen they usually gave sufficient detail to score two marks.

6 (a) The combined contraceptive pill contains artificial versions of oestrogen and progesterone.

(i) Explain how the combined contraceptive pill prevents pregnancy.

(2)

It reduces the level of LH  
and FSH which ~~reduces~~ stops the  
egg from being produced and  
therefore cannot be fertilised



In this answer it refers to the hormones oestrogen and progesterone. Reduces the level of LH and FSH is 1 mark. Stops the egg being produced is not enough for preventing ovulation.

6 (a) The combined contraceptive pill contains artificial versions of oestrogen and progesterone.

(i) Explain how the combined contraceptive pill prevents pregnancy.

(2)

The higher concentration of oestrogen and progestin prevents menstruation which prepares the egg for fertilisation.



**ResultsPlus**  
Examiner Comments

Many candidates talked about preventing menstruation or about the lining of the uterus, this does not answer the question. 0 marks awarded.

## Question 6 (a)(ii)

This question caused few problems, with the overwhelming majority of candidates able to identify that STIs could still be spread, and a smaller – but still significant number – referring to the slight chance of pregnancy. Most incorrect responses were distracted by the idea of forgetting to take the pill or side effects of the pill which was not the reason why using the combined pill as the only form of contraception was a disadvantage.

(ii) When taken correctly, the combined pill can be over 99% effective.

Taking the combined pill can lead to weight gain.

Give **one** other disadvantage of using the combined pill as the only method of contraception.

(1)

.....  
Hormonal changes (change in mood)



**ResultsPlus**  
Examiner Comments

We did not credit side effects of the pill as this is not a disadvantage of using the pill as the ONLY form of contraception.

(ii) When taken correctly, the combined pill can be over 99% effective.

Taking the combined pill can lead to weight gain.

Give **one** other disadvantage of using the combined pill as the only method of contraception.

(1)

.....  
it must be taken daily



**ResultsPlus**  
Examiner Comments

Comments on the taking of the combined pill were not credited.

(ii) When taken correctly, the combined pill can be over 99% effective.

Taking the combined pill can lead to weight gain.

Give **one** other disadvantage of using the combined pill as the only method of contraception.

(1)

It doesn't protect against STDs or STIs.



**ResultsPlus**  
Examiner Comments

The prevention of STIs or STDs was the most common answer and was credited for 1 mark.

## Question 6 (b)

Most candidates gained MP1 for stating that blood glucose levels were high, comparatively few stated that this was due to the inability to regulate blood glucose. MP2 was often gained for stating that the cells were resistant to insulin, but it was necessary to ignore the fact that they had also stated that the individual did not produce enough insulin (which is not incorrect) – there was a lack of clarity of expression around the idea of “insulin resistance” with many candidates referring to insulin being “ineffective” (but which could be due to changed insulin structure, rather than tissue resistance) or the body cells being “immune” to insulin. MP3 was not often awarded as few candidates were able to relate the resistance to insulin to the ability to convert glucose in the blood to glycogen in the liver.

(b) Excessive weight gain and obesity increase the likelihood of developing type 2 diabetes.

Explain the effect of type 2 diabetes on the body.

(3)

~~There's~~ The blood sugar level is too ~~to~~ high, so people who has type 2 diabetes will be more likely to get cardiovascular disease, and will get tired easily, because there's too much glucose in the body that the liver can't turn them all into glycogen, and the person's urine will be sweet because the body can't break down all the glucose.



Blood sugar levels are high is acceptable for high blood glucose for 1 mark. Ignore reference to cardiovascular disease, this is not an accepted side effect. Accept tired for a symptom as outlined in the additional guidance column. Glucose cannot be converted into glycogen is worth a mark so 3 marks can be awarded.



Note this is an 'explain' question so scientific detail is required in the answer. Blood glucose levels increase BECAUSE glucose cannot be converted into glycogen.

(b) Excessive weight gain and obesity increase the likelihood of developing type 2 diabetes.

Explain the effect of type 2 diabetes on the body.

(3)

Type 2 diabetes causes your organs to be ~~immune~~ immune and unresponsive to insulin, therefore even though insulin is still produced at the pancreas it does not ~~take~~ take an effect ~~at~~ and lowers ~~your~~ the blood sugar. This is because ~~the~~ the liver will not respond to it and will not turn glucose in the blood into glycogen. ~~with~~ This means that ~~you~~ the blood sugar will remain high.



**ResultsPlus**  
Examiner Comments

Unresponsive to insulin could be given but the candidate has said immune which is a reject against this marking point so this cannot be awarded the mark. No glucose to glycogen is 1 mark. Blood sugar levels are high is also acceptable for 1 mark. 2 marks awarded.

## Question 6 (c)

Some candidates were unable to correctly interpret the data, with many stating that blood glucose and red blood cells were also above the normal range. Only a few of the stronger candidates scored on MP4, MP5 & MP6 as candidates concentrated only on the elevated levels of TSH and thyroxine and failed to appreciate the significance of the tests that were within the normal range. Many good candidates lost marks for overcomplicating the question, giving detailed responses about negative feedback and TRH but then managed to negate/miss out on relevant information about TSH and its stimulation of the thyroid gland.

- (c) A woman had unexplained weight loss and fatigue. She had blood tests to investigate the cause of these symptoms.

Figure 10 shows the results.

blood test	woman's result	normal range
TSH level	5.6 mU/l	0.4 to 4.9 mU/l
thyroxine level	27.5 pmol/l	9.0 to 21.0 pmol/l
red blood cell count	$5.2 \times 10^6$ cells/ $\mu$ l	4.2 to $5.4 \times 10^6$ cells/ $\mu$ l
glucose level	82.0 mg/dl	72.0 to 99.0 mg/dl

Figure 10

Comment on the results of these blood tests and the possible causes of the woman's weight loss and fatigue.

(4)

Firstly, the woman's TSH level is high above normal range at 5.6 mU/l which shows that the pituitary gland is releasing a lot of thyroid stimulating hormone (TSH) which explains why her thyroxine levels are high, also above average at 27.5 pmol/l which is 6.5 pmol/l above average. This evidence suggests the woman has an overactive thyroid and this will cause weight loss because thyroxine controls metabolic processes in the body which will cause weight loss as there are high rates of metabolic reactions taking place. There are normal levels of glucose and red blood cell count, showing reinforcing the fact it is most likely her thyroid causing the symptoms.

(Total for Question 6 = 10 marks)



1 mark can be awarded for high levels of TSH or high levels of thyroxine; the second mark cannot be awarded as they have not stated TSH STIMULATES the release of thyroxine. Overactive thyroid is acceptable for hyperthyroidism for 1 mark. High rates of metabolic reactions is the same mark point as overactive thyroid. Normal levels of glucose and red blood cells is 1 mark. 3 marks awarded.

- (c) A woman had unexplained weight loss and fatigue. She had blood tests to investigate the cause of these symptoms.

Figure 10 shows the results.

blood test	woman's result	normal range
TSH level	5.6 mU/l	0.4 to 4.9 mU/l
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glucose level	82.0 mg/dl	72.0 to 99.0 mg/dl

**Figure 10**

Comment on the results of these blood tests and the possible causes of the woman's weight loss and fatigue.

(4)

The TSH levels are far higher than the average, which means her body thinks she is too heavy therefore sends TSH to slow down her liver from producing insulin, therefore she has fatigue + weight loss. Her thyroxine level is also above the normal range which means her body is trying to get rid of glucose from her blood, which she does not need to do as her glucose levels are already average. Her <sup>body</sup> possibly helped regulate the glucose level by raising the TSH and thyroxine levels as her red blood count is also within the normal range.



TSH is far higher than average is not enough for the first marking point but the candidate goes onto say thyroxine level is above the normal range which means this can be awarded a mark. Red blood cell count is within the normal range so can also be awarded 1 mark.  
2 marks awarded.



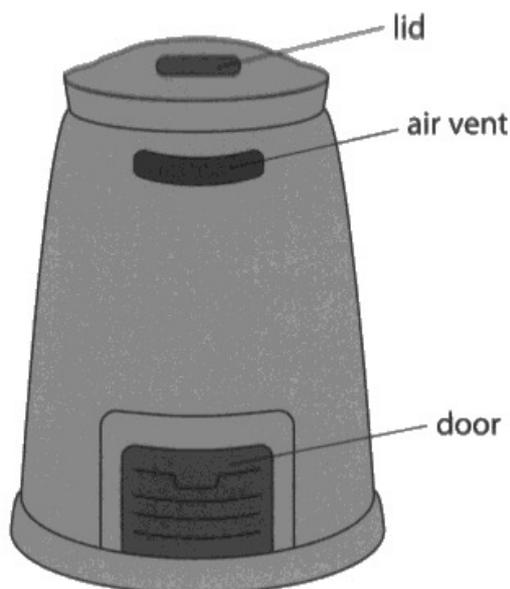
When given a table of data please comment on all the data to maximise your marks.

## Question 7 (a)(i)

Candidates found it difficult to express the idea that this was a website where the people were experts or that it was a reliable website, with many candidates just referring to them giving details or a diagram as the reason for this being a good source of information.

- 7 (a) A gardener read information on a gardening society website about how to use a compost bin.

Figure 11 shows the compost bin and some of the instructions.



- add soil in between layers of vegetation
- mix the contents of the compost bin once a month to add air
- keep the lid on to prevent water entering

Figure 11

- (i) Give **one** reason why the gardener thought the gardening society website was a good source of information.

(1)

Because they are clear instructions  
which go with the compost bin.



References to the instructions being included is not sufficient for the mark as we are looking for some level of expertise in gardening as the reason it was a good source of information.

## Question 7 (a)(ii)

Those candidates who answered this the best split up the two parts of the question, linking adding the soil to provide decomposers and turning the soil to the idea of decomposers needing oxygen for respiration.

- (ii) Give reasons why soil is added to the compost bin and why the contents are turned to add air.

(2)

the soil provides a place for the nutrients, minerals and energy to be stored when the compost breaks down. Oxygen is needed for the compost to decompose so adding air will top up the oxygen levels that is used up during the decomposition.



Oxygen is needed is enough for the second mark point. We did not award the mark for the vegetation decomposing as the answer must be specific to decomposers/bacteria or types of decomposers.

- (ii) Give reasons why soil is added to the compost bin and why the contents are turned to add air.

(2)

~~Soil is added to provide nutrients for the veget organisms to break down~~  
~~the vegetation.~~ Air is ~~also~~ needed so the organisms can respire to produce energy. Soil is added to provide nutrients/food for the organisms so they can respire and produce energy to break down the vegetation.



Air is needed for the organisms to respire is enough for the respiration mark. Organisms is not enough for the first marking point. 1 mark awarded.

## Question 7 (b)

Generally, there was a good understanding of the commercial use of plant hormones and in particular, the role of ethene in fruit ripening and candidates were able to link this effect to the idea of picking the fruit and transporting it when unripe to prevent bruising etc then ripening at the destination for sale. The many roles of gibberellins were described and there was evidence of some excellent understanding of why germination needed to be promoted and the process of producing seedless fruits with some excellent detail linking flowering to photoperiodism. The role of auxins in rooting powders and as selective weedkillers was less well understood and many candidates talked about phototropism and gravitropism instead of answering in terms of commercial production of plants.

used to help fruit last longer  
used to create larger fruit used to ripen

\*(b) Explain the uses of auxins, gibberellins and ethene in the commercial production of plants and fruits.

(6)

plant hormones are used in the commercial production of plants and fruits to help increase the quality and the value. Auxin is used to create larger fruit and helps speed up the time it takes to grow. Gibberellins is used to ripen fruit such as bananas. This means the fruit can be picked and sold quicker. Ethene is used to help preserve the plants and fruit to give it a longer shelf life.



**ResultsPlus**  
Examiner Comments

There are hormones mentioned here but in the wrong context. The hormone names are given in the stem of the question, so this is not a creditworthy response. 0 marks awarded.

\* (b) Explain the uses of auxins, gibberellins and ethene in the commercial production of plants and fruits.

→ germ

→ ripens

(6)

Auxins stimulate growth in the shoots of plants. Auxins are used commercially to speed up growth of plants so they can be harvested quicker.

Gibberellins stimulate germination of plants, so their seeds will be released quicker. They're used commercially so the next generation of plants can be planted, ~~ready for harvest~~ <sup>to meet demand.</sup>

Ethene stimulates the ripening of fruit. This means the fruit, for example bananas, can be harvested before they're ripe and therefore during transport won't bruise as easily. Then they are sprayed with ethene which causes rapid ripening of the fruit, so they are freshly ripe when sold.



**ResultsPlus**  
Examiner Comments

Auxins are only linked to general growth, so no marks awarded yet. Gibberellins linked to seed germination puts the response into level 1 but there is no information for why seed germination is needed. Ethene stimulates fruit ripening puts the response into level 2 which prevents bruising and causes rapid ripening is enough for a process. As we only have a process for ethene and not gibberellins this cannot be the top of level 2. 3 marks awarded.



**ResultsPlus**  
Examiner Tip

When answering extended open response questions it is fine to divide your answer into sections. In this case the sections would be each of the hormones.

\* (b) Explain the uses of auxins, gibberellins and ethene in the commercial production of plants and fruits.

(6)

Auxins are used ~~as seeds~~ to grow plants. Part of a plant is cut off and auxin powder is added, then ~~the~~ it is put into the soil. This allows the part of a plant to grow into a plant, which without auxins would not have grown in the soil.

Gibberellins are used to help plants flower. Gibberellins are added to the plant to ~~to~~ make the plant flower at a faster rate than it would have if not added, or if the flower was out of season.

Ethene ~~is~~ added to fruits to make them ripen. Fruits on their journey to supermarkets can be given ethene to make them become ripe at a ~~faster~~ ~~at~~ fast rate.



**ResultsPlus**  
Examiner Comments

Auxin powder is acceptable for rooting powder, so the candidate is in level 1. There is no clear process for this so they cannot move to the top of level 1. Gibberellins use in flower formation is given so we can move to level 2. This candidate has linked this to flowering out of season so they can go to the top of level 2. Ethene make fruits ripen puts the response into level 3, allows them to ripen at a faster rate is a process. This response is in level 3 but as there is no process for auxin, we cannot put it at the top of level 3.

Note the use puts it in the level, the process puts it to the top of the level. 5 marks awarded.

\*(b) Explain the uses of auxins, gibberellins and ethene in the commercial production of plants and fruits.

(6)

Auxins, gibberellins and ethene are plant hormones that can play a role in increasing yields in commercial production of plants and fruits.

Auxins stimulate the growth of the shoots and roots of plants, therefore increasing yields. They are sprayed onto plants in sunlight, and the auxins on the sunlit side of the plant move to the shaded side and elongate towards the sun, causing a positive phototropism. There is also a positive gravitropism, as the roots grow downwards on the sunlit side of the plant. This promoted growth increases the yields of plants.

Gibberellins and ethene play a role in the growth and ripening of fruits. This means that a higher yield is obtained in commercial production.

Ethene is the one that ripens fruits → a benefit of this is more fruit is ripe enough to sell, so more can be grown and more money can be made.

(Total for Question 7 = 11 marks)



There are no marks for a description of phototropism or gravitropism as this is not a commercial use of auxins. The answer correctly links ethene to fruit ripening which puts the answer into level 1. More fruit is ripe enough to sell is enough to get it to the top of level 1 for 2 marks.

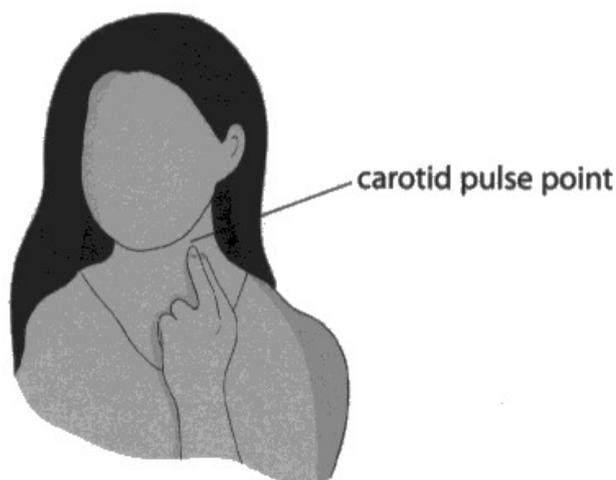
## Question 8 (a)(i)

A surprisingly high number of candidates struggled to identify how to calculate the beats per minute whilst a significant number interpreted the question as to how to physically feel the pulse rather than count it. It is important that candidates read the information given as often this will hold the key to the answer.

- 8 The effect of different types of exercise on the heart rate of an athlete was investigated.

The athlete counted the number of beats in 10 seconds at the carotid artery pulse point, as shown in Figure 12.

This measurement was used to calculate the heart rate.



(Source: © dityazemli/Shutterstock)

**Figure 12**

The athlete exercised for 20 minutes.

The heart rate was recorded every 5 minutes during each type of exercise.

- (a) (i) State how the heart rate was calculated using this method.

(1)

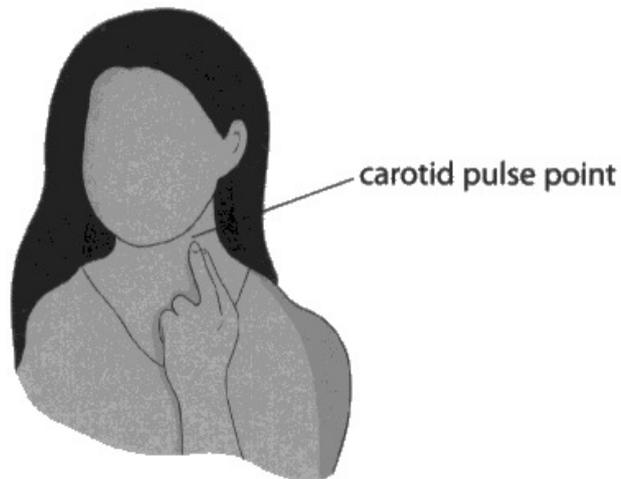
pulse per minute.

This does not answer how to calculate the heart rate, so no mark awarded.

- 8** The effect of different types of exercise on the heart rate of an athlete was investigated.

The athlete counted the number of beats in 10 seconds at the carotid artery pulse point, as shown in Figure 12.

This measurement was used to calculate the heart rate.



(Source: © dityazemli/Shutterstock)

**Figure 12**

The athlete exercised for 20 minutes.

The heart rate was recorded every 5 minutes during each type of exercise.

- (a) (i) State how the heart rate was calculated using this method.

(1)

how many pulses in 10 seconds



This response does not explain how to calculate heart rate in beats per minute. 0 marks awarded.

## Question 8 (a)(ii)

The overwhelming majority of candidates were able to identify a heart rate monitor or fitness monitor (smartwatch or Fitbit were stated frequently) but a significant number offered a stopwatch or machine without any further explanation. Taking readings for longer or repeating readings were also popular responses.

(ii) Give **two** ways of improving the method used to obtain the data needed to calculate the heart rate.

(2)

1. measure the ~~10~~ beats for 30 seconds as the heart rate might not be constant.
2. use a piece of equipment such as a heart monitor as it's more accurate.



1 mark can be awarded for measure the heart for longer. 1 mark can be awarded for using the heart monitor. 2 marks awarded.

(ii) Give **two** ways of improving the method used to obtain the data needed to calculate the heart rate.

(2)

1. Use a longer time ~~at~~
2. ~~the~~ ~~have~~ a ~~greater~~ amount of athletes. Repeat the experiment on a numerous amounts of ~~the~~ athletes to ~~increase~~ ~~the~~ ~~am~~ compare the heart rates.



Use a longer time is fine for 1 mark. Repeat the experiment is enough for 1 mark. 2 marks awarded.

### Question 8 (a)(iii)

It appears candidates are improving when answering this style of question asking them to comment on the data with the majority of candidates able to talk about heart rate increasing when running and quoting relevant data. Candidates were less able to talk about a small fluctuation when walking although many gained this mark by stating it rose and fell between 90bpm and 96bpm. The levelling out of the heart rate when running between 15 and 20 minutes at 180bpm was missed by many candidates.

Figure 13 shows the results of this investigation.

type of exercise	heart rate in bpm				
	0 minutes	5 minutes	10 minutes	15 minutes	20 minutes
running	90	156	168	180	180
walking	90	96	90	96	90

Figure 13

(iii) Comment on the difference in the heart rates during these types of exercise.

(3)

~~the~~ During running the heart rate increases as you pick up speed, using more energy as you respire more & the heart needs to pump oxygen around your body faster. But after a while a constant speed should be maintained so a constant heart rate should be too. <sup>During</sup> walking you're not pushing your body as hard so will respire less than running so your heart rate shouldn't increase loads above average.



During running the heart rate increases is 1 mark. We cannot award the first marking point as they refer to the heart rate not increasing loads over average which is not clear. 1 mark awarded.

Figure 13 shows the results of this investigation.

type of exercise	heart rate in bpm				
	0 minutes	5 minutes	10 minutes	15 minutes	20 minutes
running	90	156	168	180	180
walking	90	96	90	96	90

Figure 13

(iii) Comment on the difference in the heart rates during these types of exercise.

(3)

Running causes the heart to beat much faster than walking. At 0 minutes they are the same but at 5 minutes running has drastically changed. By 15 minutes the heart is beating twice as fast for running ~~with~~ but only 6 beats faster for walking.



1 mark awarded for heart rate increases when running. We cannot award the first marking point as they do not refer to fluctuating or remaining relatively constant when walking. 1 mark awarded.

## Question 8 (b)(i)

Most candidates recognised that adrenalin is released from the adrenal gland although a few mixed this up with the pituitary gland.

(b) Exercise increases adrenalin levels.

(i) State which endocrine gland secretes adrenalin.

(1)

Adrenal

---



Adrenal on its own is fine for the mark as we ask for which endocrine gland in the question.

## Question 8 (b)(ii)

The understanding of the effect of adrenalin on the liver proved to be a problem. Many candidates link this to higher blood pressure or more blood flow rather than the releasing of glucose from glycogen in the liver causing an increase in blood glucose levels. Some of the higher-level candidates were able to recognise that adrenalin binds to receptor sites on the liver.

(ii) Explain the effect of adrenalin on liver cells during exercise.

(3)

it increases the amount of glycogen in the liver being converted into glucose in the blood stream, giving the body more energy.



**ResultsPlus**  
Examiner Comments

Increases the amount of glycogen (in the liver) is 1 mark, converted to glucose the second mark, in the blood stream the third mark so 3 marks awarded. It is not essential to write a long paragraph to attain all of the marks.

(ii) Explain the effect of adrenalin on liver cells during exercise.

(3)

not cause fatty cells in the liver to release stored glucose energy.



**ResultsPlus**  
Examiner Comments

Release stored glucose is enough for 1 mark.

## Question 8 (c)

This question was well answered with most candidates able to identify lactic acid building up. Some candidates correctly linked this to anaerobic respiration to attain full marks. Some candidates incorrectly linked the change in pH to sweating more.

- (c) After high intensity exercise, the pH of muscles can decrease from pH 7.0 to pH 6.3.

Explain this change in pH.

(2)

The change in pH could be because of the amount of lactic acid being created which changes the pH.



**ResultsPlus**  
Examiner Comments

1 mark for lactic acid, unfortunately this is not linked to anaerobic respiration so only 1 mark awarded.

- (c) After high intensity exercise, the pH of muscles can decrease from pH 7.0 to pH 6.3.

Explain this change in pH.

(2)

Lactic acid is produced when glucose is broken down during respiration. The muscles are gaining acidity.



**ResultsPlus**  
Examiner Comments

1 mark awarded for lactic acid MP1. No mark for respiration, it must be anaerobic respiration.

### **Question 9 (a)(i)**

The majority of candidates scored all three marks. The most common mistake was leaving the estimate of the population as a decimal instead of rounding to a whole number, candidates did not understand that a fraction of an organism is not a possibility. A small number of candidates did not subtract the number they calculated from 50 but were still able to gain two of the three available marks.

- 9 (a) Scientists use a technique called mark and recapture to estimate animal populations in a habitat.

A sample of the population is captured and a harmless mark is added to each animal.

These animals are released and after a period of time the population is sampled again.

This second sample includes some recaptured animals that have marks on them.

The population can be estimated using this equation

$$\text{population size} = \frac{\text{number marked in the first sample} \times \text{size of the second sample}}{\text{number recaptured in the second sample}}$$

A scientist used this technique to determine the change in the population size of snails in a pond from March to July.

Figure 14 shows the results.

month	number marked in the first sample	size of the second sample	number of recaptured animals	population size
March	18	22	8	50
July	12	18	10	

Figure 14

- (i) Using data from Figure 14, calculate the difference in the population size from March to July.

$$\begin{array}{l}
 \frac{18 \times 22}{8} = 49.5 = 50 \\
 \frac{12 \times 18}{10} = 3.6 = 4 \\
 \begin{array}{r}
 12 \quad 18 \quad 10 \\
 \times 3 \quad \times 3 \quad \times 3 \\
 \hline
 36 \quad 54 \quad 30
 \end{array} \\
 \frac{36 \times 54}{30} = 64.8 \\
 \begin{array}{r}
 18 \quad 22 \quad 8 \\
 \times 2 \quad \times 2 \quad \times 2 \\
 \hline
 36 \quad 44 \quad 16 \\
 \hline
 \frac{36 \times 44}{10} = 158.4 \\
 \begin{array}{r}
 158.4 \\
 - 64.8 \\
 \hline
 93.6 \\
 \div 5 \\
 \hline
 18.72
 \end{array}
 \end{array}
 \end{array}
 \tag{3}$$

Difference in the population size ..... 18.72 .....



This candidate has attempted multiple calculations in the working area, we cannot choose what to mark. The answer on the answer line is incorrect so no marks can be awarded.

- 9 (a) Scientists use a technique called mark and recapture to estimate animal populations in a habitat.

A sample of the population is captured and a harmless mark is added to each animal.

These animals are released and after a period of time the population is sampled again.

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Figure 14

- (i) Using data from Figure 14, calculate the difference in the population size from March to July.

(3)

$$\frac{12 \times 18}{10} = 21.6$$

$$50 - 21.6 = 28.4$$

Difference in the population size .....28.4.....



This is in the additional guidance for 2 marks. The candidate has completed the correct calculation but not rounded to the total number of organisms.

## Question 9 (a)(ii)

Many candidates had little knowledge of how to control the sample and provided responses including the weather or area within the lake (depth of sampling was never seen). The more knowledgeable candidates mentioned the same points, such as a method of marking the snails with a permanent pen, same time spent sampling (if you saw the latter point mentioned then invariably two marks were scored). Some candidates showed no understanding of how to sample a population, characterised by responses suggesting capturing the same number of animals in each sample or sampling only one species.

(ii) State **two** factors the scientist should control when sampling the habitat in March and July.

(2)

1. Size of habitat

2. Temperature



**ResultsPlus**  
Examiner Comments

This is not creditable as they sampled the same habitat each time and the temperature cannot be controlled.

(ii) State **two** factors the scientist should control when sampling the habitat in March and July.

(2)

1. The area where they recapture the animals

2. The time of day they capture the animals.



Nothing awarded for the area as they state the same habitat in the stem of the question. 1 mark for the time of day they capture the animals, this was the most common marking point.

## Question 9 (b)

The vast majority of candidates gained MP1 by identifying fertilisers/leeching (usually both) being factors but then very few candidates went on to gain MP2 causing a build-up of nitrates. Many candidates talked about the effects of eutrophication rather than the cause, referring to algal blooms and plants in the pond being unable to photosynthesis. It is important that candidates read the question carefully before answering.

Look for the species at the same time so that they aren't sleeping when they wake the swimmers look  
(b) This pond is affected by eutrophication. ~~for the species.~~

Explain **one** possible cause of eutrophication.

(2)

Fertiliser from <sup>a nearby</sup> farms could run off into the pond through heavy rainfall because the fertiliser would go into the soil water which might cause them to go into the pond where they cause an algae bloom which kills other plants by stopping them from getting any sunlight for photosynthesis which reduces oxygen levels and causes death of other species that need a lot of oxygen.



**ResultsPlus**  
Examiner Comments

This candidate would have been awarded 1 mark for fertilisers or run off. No mention of build-up of nitrates or phosphates so 1 mark awarded.

## Question 9 (c)

Most candidates were able to link this to photosynthesis and named greenhouse gases – the stronger candidates were able to relate this to climate change/global warming. However, very few candidates could give a good account of animal conservation with most only really able to gain credit from the “stop animals from going extinct” idea. Very few candidates were able to relate animal conservation to the maintenance of food webs (a few discussed food chains) but fewer still made any reference to the maintenance, or importance of maintaining genetic diversity. The best responses did refer to breeding programmes in zoos and ecotourism.

Some candidates wrote very good responses on reforestation, but ignored animal conservation entirely, limiting themselves to level 1.

A significant number of candidates only mentioned one point about animal conservation programmes, invariably the preservation of species, and were limited to level 2, despite excellent responses on reforestation.

\* (c) Reforestation has a beneficial effect on air composition and biodiversity.

Animal conservation projects can also have a beneficial effect on biodiversity.

Explain the beneficial effects of reforestation and animal conservation projects.

(6)

Reforestation is beneficial and needed due to how, although trees are still cut, it is done so where only a small portion of an area is cut. Which allows for other saplings to grow. As a result, it improves upon the air composition and allows for animal biodiversity (due to animals and insects still having a place to go to).

Animal conservation projects are also very useful as it aids reduce chances of any animal going extinct. As for example, Rhinos and their horns.



This candidate has been awarded 3 marks, they have given one of the indicative comments from the mark scheme for reforestation but have only stated that it reduces the chances of animals going extinct for animal conservation. This puts them into level 2 and as there is only one comment on animal conservation 3 marks for level 2 are awarded.

Comments about improving the air composition and biodiversity are in the stem of the question so are not creditable.



When answering an open ended question about two separate pieces of information separate these out into two separate paragraphs.

\*(c) Reforestation has a beneficial effect on air composition and biodiversity.

Animal conservation projects can also have a beneficial effect on biodiversity.

Explain the beneficial effects of reforestation and animal conservation projects.

(6)

Firstly, reforestation can restore habitats of species and increase the biodiversity in an area. Reforestation also provides leads to the trees providing ecosystem services including protection against flooding and the cycling water through evapotranspiration. Furthermore, planting more trees also helps reducing global warming since they take in carbon dioxide from the air during the day and ~~release oxygen during the night~~ stores them in the roots, acting like a 'carbon sink'.

Animal conservation projects can help maintaining biodiversity by protecting the ~~endangered~~ endangered animals from extinction. ~~When animals~~ This is very important since when ~~an~~ a species goes extinct, other species that are dependent or preyed upon by it will be heavily affected, causing the ecosystem to be unstable.



This response includes more than one comment about both animal conservation and reforestation so can be put into level 3. They do not mention the gas exchange of oxygen and carbon dioxide so cannot get to the top of level 3. 5 marks are awarded.

\* (c) Reforestation has a beneficial effect on air composition and biodiversity.

Animal conservation projects can also have a beneficial effect on biodiversity.

Explain the beneficial effects of reforestation and animal conservation projects.

(6)

One beneficial effect of reforestation is that the trees absorb ~~oxygen~~ <sup>Carbon dioxide</sup> and give out oxygen which reduces climate change and global warming. In addition, reforestation reduces the risks of droughts as it increases evapotranspiration and reduces run off into bodies of water such as ponds and lakes. In addition reforestation increases the natural habitat of endangered species as they have more living space, food and shelter and food which will increase the likelihood of an increase in population. This will also lead to an increased biodiversity as the reforested area could be home to ~~many~~ <sup>a variety</sup> of species which will be important to maintain the ecosystem through interdependence.

Animal conservation projects can be very important for the biodiversity as they can ensure the survival of indigenous species and reduce the population of invasive species. In ~~the~~ the UK for example, there are some forests where the invasive grey squirrels get killed when they are seen to reduce increase the population of the red squirrel that is endangered due to the increased competition by the grey squirrel. Therefore, this is an example of how animal conservation projects can increase biodiversity as they ensure survival of endangered species. Another type of animal conservation project is to keep endangered species in the zoo such as the South China tiger that hasn't been seen in the wild for over 20 years and only 70 animals exist, all found in zoos. In order to preserve the species, they are kept safe and bred in the zoo before being put back into their original natural habitat.

(Total for Question 9 = 13 marks)



This response refers to two or more comments from the indicative content about both reforestation and animal conservation and also includes the gas exchange of oxygen and carbon dioxide in reforestation. The candidate also includes a reference to the effect of animal conservation on food chains so can be awarded 6 marks.

## Question 10 (a)

This question was the planning question that appears on all papers and referred to the suitability of three different materials for training. Candidates related reasonably well to this, often talking about completing the same exercise in different T-Shirts and recording the change in mass to see which one absorbed the most sweat. Very few candidates referred to keeping the same environmental conditions to exercise in such as temperature etc. The alternative method of wetting the T-Shirt with the same volume of water and measuring the change in mass was seen less often.

**10 (a)** When training, an athlete noticed some types of T-shirts became wetter and heavier due to sweating.

This athlete has three T-shirts, each made of a different material.

Devise a method this athlete could use to find the best T-shirt for training.

(3)

put water on a surface and see which one absorbs in the fastest then ~~measure~~ weigh them to see which one is heaviest with the water absorbed into them and finally see put them in the sun and see which one dries the fastest, repeat these multiple times and take an average.



**ResultsPlus**  
Examiner Comments

1 mark here for the second set of marking points for wet the T-Shirt. There is no comment about controlling the volume of water so this mark cannot be awarded. They have not measured a change in weight so cannot be awarded change in mass. We would accept change in weight for change in mass.

10 (a) When training, an athlete noticed some types of T-shirts became wetter and heavier due to sweating.

This athlete has three T-shirts, each made of a different material.

Devise a method this athlete could use to find the best T-shirt for training.

(3)

The athlete could get a water + salt solution. Then weigh all of the T-shirts dry. Using an equal volume of water across each t-shirt pour the solution onto the T-shirt and weigh them. Let them sit for two minutes and then weigh each T-shirt and find the difference between the original and wet weights. The ~~lightest one~~ lowest difference ~~is~~ is the best.



This candidate has followed the second set of marking points. Equal volume of water is the second marking point. Pour on the solution is the first marking point. Weigh the T-Shirts and find the difference is fine for change in mass for the third marking point. The lowest difference is the best is the last marking point, so 3 marks can be awarded.

**10 (a)** When training, an athlete noticed some types of T-shirts became wetter and heavier due to sweating.

This athlete has three T-shirts, each made of a different material.

Devise a method this athlete could use to find the best T-shirt for training.

(3)

Train in a normal t-shirt. Then train in different T-shirts (different materials - lycra, nylon ect). Then he should measure the absorption of sweat and the visibility of sweat. Whichever absorbs the most sweat and has the least visibility of sweat patches is the best T-shirt for training.



**ResultsPlus**  
Examiner Comments

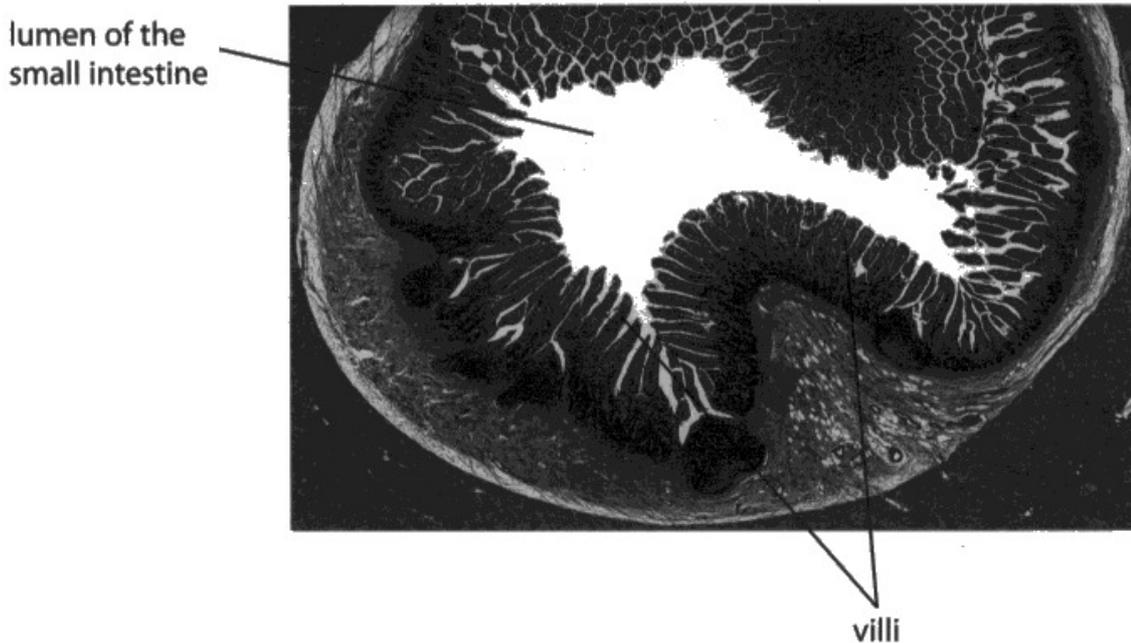
This response has not referred to training at the same intensity or for the same amount of time or same exercise, so the first marking point cannot be awarded. They state measure the absorption of sweat but no method for doing this so cannot be given change in mass. 0 marks awarded.

## Question 10 (b)(ii)

It is pleasing to note that Fick's Law appears to be better understood than when it was last assessed and most candidates gained two marks for stating that the villi increased the surface area so increased the rate of diffusion. Where the equation was quoted, candidates often put the equals sign rather than the proportionality sign.

(ii) Digested protein is absorbed in the small intestine by diffusion.

Figure 15 shows part of the small intestine.



(Source: © Science Photo Library C047/6177)

**Figure 15**

Using Figure 15 and Fick's law, explain the effect of the villi on the rate of diffusion.

(3)

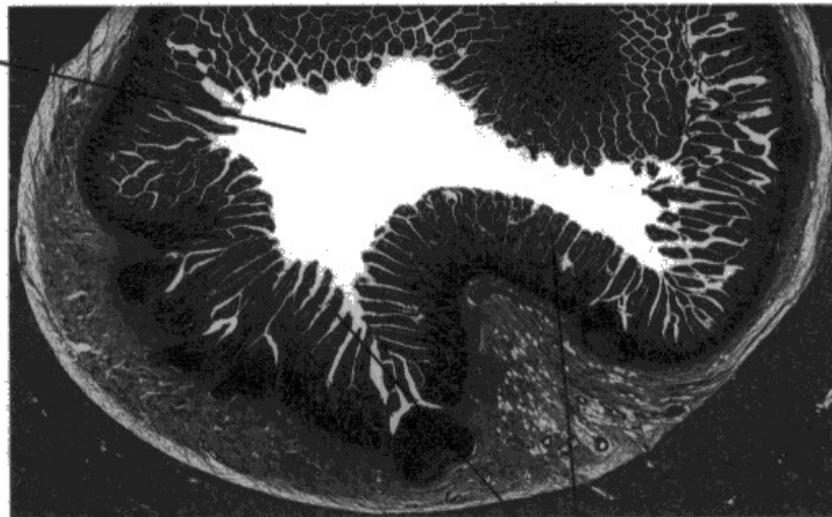
the villi will move along the pre diffused proteins allowing more to diffuse in, speeding up the process

1 mark awarded for more diffusion.

(ii) Digested protein is absorbed in the small intestine by diffusion.

Figure 15 shows part of the small intestine.

lumen of the  
small intestine



villi

(Source: © Science Photo Library C047/6177)

**Figure 15**

Using Figure 15 and Fick's law, explain the effect of the villi on the rate of diffusion.

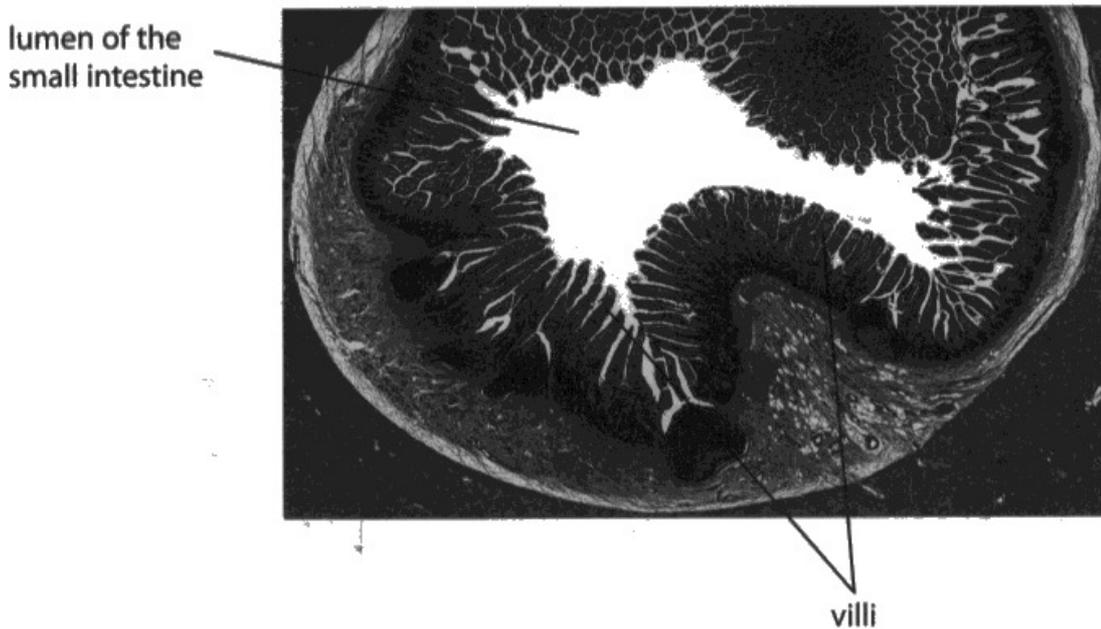
(3)

Villi increases the surface area. Surface area is directly proportional to rate of diffusion. If the surface area is higher there is more space for diffusion to occur therefore increasing the rate of diffusion.

More surface area is 1 mark. More diffusion is 1 mark. This was the most common response.

(ii) Digested protein is absorbed in the small intestine by diffusion.

Figure 15 shows part of the small intestine.



(Source: © Science Photo Library C047/6177)

**Figure 15**

Using Figure 15 and Fick's law, explain the effect of the villi on the rate of diffusion.

(3)

Fick's law states the rate of diffusion is equal to  $\frac{\text{surface area} \times \text{concentration difference}}{\text{thickness of wall}}$ .  
So the villi's large surface area to thickness will increase the rate of diffusion.



Fick's law is incorrectly stated but we can allow more surface area and more diffusion for 2 marks.

### **Question 10 (b)(iii)**

It was surprising how few candidates were able to identify plasma as the substance that carries amino acids around the body. Answers varied from red blood cells to white blood cells to platelets and most commonly plasmids.

## Question 10 (c)

This question was a synoptic question linking both the breakdown of amino acids by deamination in the liver to the production of urine in the nephron. Many candidates struggled to put both parts of this into their answer but the more able candidates scored full marks throughout. A lot of candidates just repeated the question in their answer which did not score any marks. There was very little understanding of the process of deamination.

(c) Explain how high levels of amino acids in the blood cause a high concentration of urea in urine.

(4)

Urea is the breaking down of amino acids into a waste product in the liver. Therefore, as there is a high level of amino acids in the blood this can when urine is formed this causes a high concentration of urea as the body needs to regulate its level of amino acids through a negative feedback loop.



**ResultsPlus**  
Examiner Comments

Urea is the breaking down of amino acids in the liver is MP2, 2 marks.



**ResultsPlus**  
Examiner Tip

This is a synoptic question and has two strands, first the formation of urea and then how this is converted into urine, so both parts must be addressed to achieve all the marks.

(c) Explain how high levels of amino acids in the blood cause a high concentration of urea in urine.

(4)

High levels of amino acids in the blood cause high concentration of urea in urine because when blood is filtered at the nephrons in the kidney, amino acids are ultrafiltered and are collected at the collecting duct, waiting to be added to urine in the bladder and deposited via the urethra. Therefore, the higher levels of amino acids in the blood, the higher to the concentration of urea in urine as the amino acids filter via the nephrons in the kidney ultimately to become part of urea, which contains other ions.

(Total for Question 10 = 12 marks)



**ResultsPlus**  
Examiner Comments

When blood is filtered at the nephrons is 1 mark. (Note they must mention blood and nephron or kidney for this mark). Ultrafiltered is the equivalent of ultrafiltration for 1 mark. Urine collected at the collecting duct is also a mark, this could also be given for urine in the bladder. There is no mention of how urea is formed so a maximum of 3 marks can be awarded.

(c) Explain how high levels of amino acids in the blood cause a high concentration of urea in urine.

(4)

Both amino acids and urea correspond  
as more amino acids results in more urea as  
they <sup>create urea</sup> ~~produce~~ within the body and once ~~they~~ ~~are~~ ~~used~~  
~~up~~ amino acids are used up it becomes urea and is  
given away from the body with urine.



**ResultsPlus**  
Examiner Comments

This response is merely a repeat of the stem of the question so cannot be awarded any marks. 0 marks scored.

## 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.
- understand that the command word 'compare' requires the answer to make comparisons between two sets of data or two concepts. Language used in responses should be comparative – 'greater', 'faster', 'quicker' etc.
- read the information given in the introduction to the question but avoid repeating it in the answer as it will not gain credit.
- ensure that methods for core practicals are understood including the differences between controls and control variables.
- ensure they consistently apply rules for rounding up numerical answers and understand recurring numbers.
- read mathematical questions carefully to note whether an answer is required in standard form or to a specified number of significant figures.

## **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>

