Pearson Edexcel

Examiners' Report June 2024

Int GCSE Biology 4BI1 1B

ResultsPlus

Introduction

The new qualification was examined for the fourth time in a June series. The examiners were once again impressed with the standard of many of the candidate responses. Centres continue to prepare candidates well for all of the styles of question and all areas of specification content. Most candidates were able to demonstrate very good levels of knowledge and understanding of the specification content. Many could also apply their knowledge to new contexts both theoretical and practical. There was little evidence of candidates running out of time on the paper and almost all candidates attempted all questions. Candidates continue to improve on those items requiring an evaluation response. In this paper these items used the command words 'comment' and 'discuss'. Centres are reminded that a list of command words appear in the appendix of the specification.

Candidates also did well on applying their knowledge to novel scenarios including those describing practical experiments. Most candidates did well on the items examining the mathematical skills outlined in the appendix at the end of the specification. In the calculations, many candidates showed their working so that even if they did not get the final answer, they were able to gain some credit.

Question 1 (a)(ii)

This item required candidates to draw a food chain from the food web provided, that includes the mouse and four trophic levels.

Most candidates were able to gain both marks for the correctly drawn food chain.

(ii) Draw a food chain, from this web, that includes the mouse and contains four trophic levels.

(2)

oak tree → caterpillar → mouse → tick

ResultsPlus
Examiner Comments

This food chain gains both marks as it contains four levels, the arrows are correct and it includes the mouse.

ResultsPlus
Examiner Tip

Always start the food chain with a producer and ensure the arrows show the direction of energy flow.

(ii) Draw a food chain, from this web, that includes the mouse and contains four trophic levels.

(2)

tick

oak tree → caterpillar → mouse → tick

ResultsPlus
Examiner Comments

This also gains both marks.

(ii) Draw a food chain, from this web, that includes the mouse and contains four trophic levels.

(2)

oak tree → caterpillar → mouse → blue jay

ResultsPlus
Examiner Comments

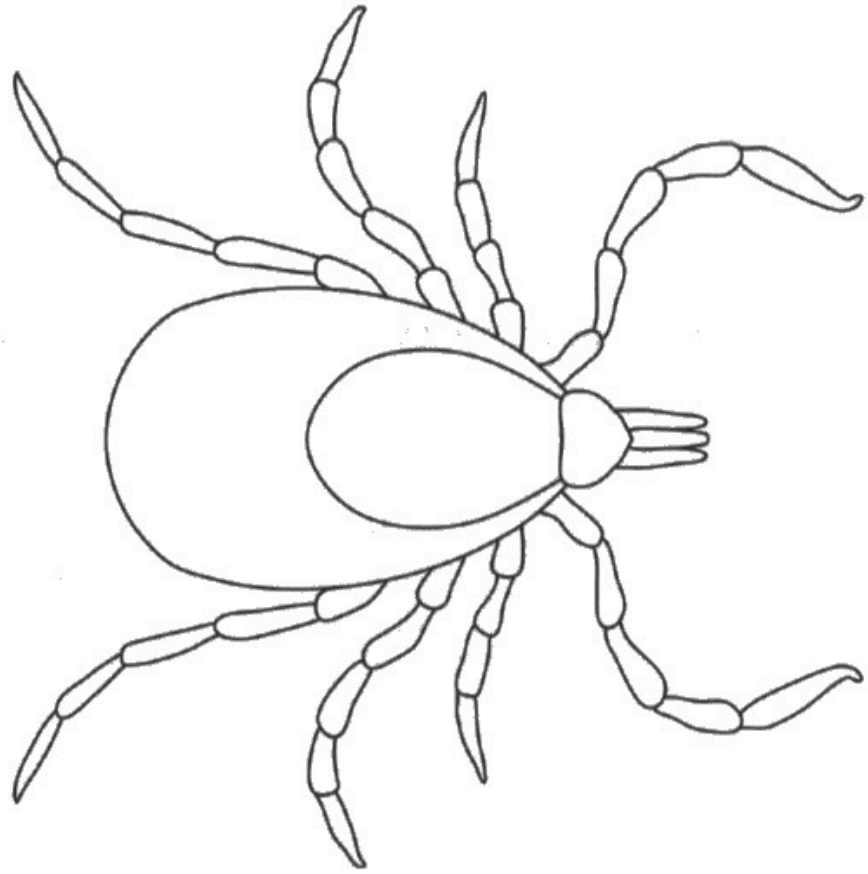
This response gains no credit as the food chain is incorrect.

Question 1 (b)(i)

Candidates were given a magnified diagram of a tick and had to calculate the magnification of the image of the tick. Most were able to gain full marks and those who got the calculation wrong could pick up one mark for correct measurement of the line AB or for dividing by 3.5.

(b) A tick is a small spider-like organism that bites and then takes in blood from the mammals as it feeds.

This is a magnified image of a tick.



(Source: © Evgdemidova / Shutterstock)

(i) The actual length of the tick, as shown by line A-B, is 3.5 mm.

Calculate the magnification of the image of the tick.

(2)

Actual length = 10.4cm

3.5mm = 0.35 cm

$\frac{10.4}{0.35} = 29.7$

magnification = x 30.0

ResultsPlus
Examiner Comments

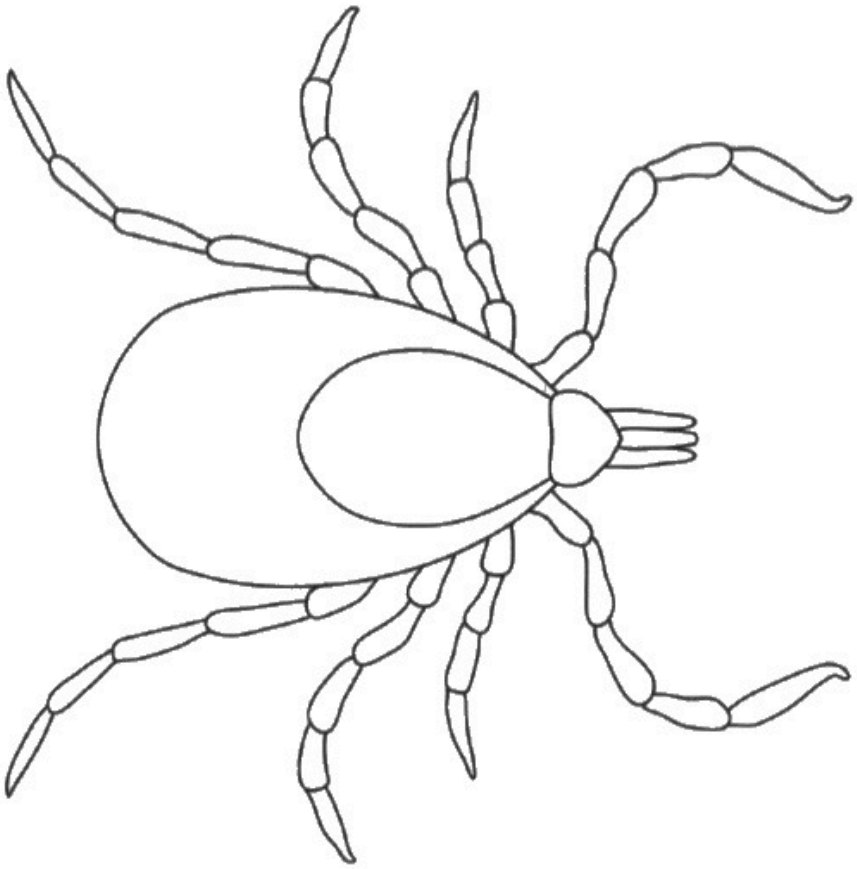
This response scores full marks for correctly calculating the magnification.

ResultsPlus
Examiner Tip

Always show the stages of your calculation.

(b) A tick is a small spider-like organism that bites and then takes in blood from the mammals as it feeds.

This is a magnified image of a tick.



(Source: © Evgdemidova / Shutterstock)

(i) The actual length of the tick, as shown by line A-B, is 3.5 mm.

Calculate the magnification of the image of the tick.

(2)

mag = measured / actual

3/1000 = 0.0035

1000 / 3.5 = 285.714285

magnification = x 285.71

ResultsPlus
Examiner Comments

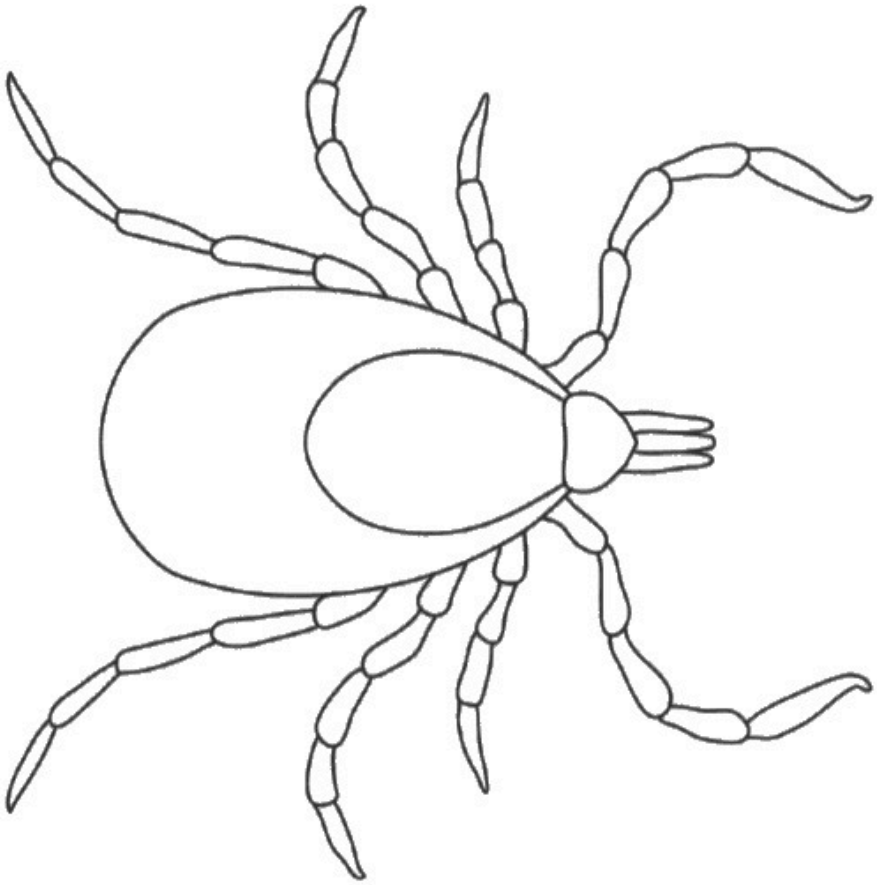
This scores one mark for dividing by 3.5.

ResultsPlus
Examiner Tip

Although this response did not get the correct answer it gained a mark for dividing by 3.5.

(b) A tick is a small spider-like organism that bites and then takes in blood from the mammals as it feeds.

This is a magnified image of a tick.



10.4cm

(Source: © Evgdemidova / Shutterstock)

(i) The actual length of the tick, as shown by line A-B, is 3.5 mm.

Calculate the magnification of the image of the tick.

(2)

$\frac{10.4\text{cm}}{3.5\text{mm}} \times 100 = \frac{1040\text{mm}}{3.5\text{mm}} = 297.1$

magnification = x 297

ResultsPlus
Examiner Comments

This response also did not get the correct answer but gained one mark for correctly measuring the line with units and for dividing by 3.5.

ResultsPlus
Examiner Tip

Make sure you are using the correct units, this response had a mixture of mm and cm that led to an error.

Question 1 (b)(ii)

In this item candidates were told that the tick absorbs substances from the mammal's blood it has taken in.

Candidates had to give the function of two named substances absorbed by the tick. Many responses gained full marks but some responses identified blood cells rather than substances carried in the blood.

(ii) The tick absorbs substances from the mammal's blood it has taken in.

Give the function of two named substances absorbed by the tick.

(4)

substance 1

Glucose for respiration to release energy.

substance 2

Proteins for growth and repair.

ResultsPlus
Examiner Comments

This response gains full marks for naming glucose and describing its function as providing energy from respiration. It also identifies proteins as being used for growth and repair.

(ii) The tick absorbs substances from the mammal's blood it has taken in.

Give the function of two named substances absorbed by the tick.

(4)

substance 1

glucose - this is a reactant of aerobic respiration and is need by the tick to produce energy for movements,

substance 2

water - water is needed by all living substances for chemical reactions to take place in the body, and for hydrations of body cells so they can function normally and carry out specific reactions.

ResultsPlus
Examiner Comments

This also gains full marks for identifying glucose and water and describing the functions of each substance.

(ii) The tick absorbs substances from the mammal's blood it has taken in.

Give the function of two named substances absorbed by the tick.

(4)

substance 1

Platelets ~~dot~~ cause blood to clot when it is exposed to air to prevent ~~bloo~~ extreme blood loss.

substance 2

amino acids in the plasma are used in protein synthesis to form proteins for growth and repair in the body.

ResultsPlus
Examiner Comments

This gains two marks for amino acids and their function in protein synthesis. No credit for platelets.

(ii) The tick absorbs substances from the mammal's blood it has taken in.

Give the function of two named substances absorbed by the tick.

(4)

substance 1

White blood cells protect the body against disease and infection

substance 2

red blood cells carry oxygen around the body

ResultsPlus
Examiner Comments

No credit for reference to blood cells.

Question 1 (b)(iii)

In this item candidates were told that ticks can pass diseases between organisms.

They were asked to suggest how ticks can pass diseases from one organism to another. Many candidates were able to correctly describe how a tick can pick up a pathogen from an infected mammal when they feed off its blood. They will then pass on this pathogen when they bite the next mammal.

(iii) Ticks can pass diseases between organisms.

Suggest how ticks can pass diseases from one organism to another.

(2)

- When a tick has finished absorbing another ~~mammal~~ mammal blood. The mammal could have carried pathogens
- When the tick bites a new organism traces of the previous mammals pathogens ~~are~~ can be deposited into the blood stream therefore passing the disease on

(Total for Question 1 = 12 marks)

ResultsPlus
Examiner Comments

This response gains full credit for absorbing pathogens with blood and biting a new organism.

(iii) Ticks can pass diseases between organisms.

Suggest how ticks can pass diseases from one organism to another.

(2)

By [redacted] through their teeth putting pathogens into mammals.

(Total for Question 1 = 12 marks)

ResultsPlus
Examiner Comments

This response gains one mark for reference to pathogens.

(iii) Ticks can pass diseases between organisms.

Suggest how ticks can pass diseases from one organism to another.

(2)

. Reproducing - passing on the allele to offspring

(Total for Question 1 = 12 marks)

ResultsPlus
Examiner Comments

This response gains no credit as the disease is not genetically transmitted.

Question 2 (b)

In question 2 candidates were given a diagram of an insect-pollinated flower.

They were asked to describe how structures P, R and T would be different in a wind-pollinated flower.

Most candidates could describe that in a wind-pollinated flower, P would be feathery and exposed, R would be smaller and dull and T would be longer exposing the anthers outside the flower.

(b) This flower is insect-pollinated.

Describe how structures P, R and T would be different in a wind-pollinated flower.

(3)

P It would be feathers and exposed to catch pollen in the air

R It would be smaller and most likely green (it does not need to attract insects)

T It would be exposed so that the wind blows the pollen away

ResultsPlus
Examiner Comments

This gains full marks for correct statements about P , R and T.

(b) This flower is insect-pollinated.

Describe how structures P, R and T would be different in a wind-pollinated flower.

(3)

P Taller to increase chance of pollen landing on.

R Much smaller to allow wind to blow the pollen grains of the plant

T Taller to increase wind blowing the pollen away.

ResultsPlus
Examiner Comments

This gains two marks for a correct statement about R and T. P is not taller so no credit for that.

(b) This flower is insect-pollinated.

Describe how structures P, R and T would be different in a wind-pollinated flower.

(3)

P they're pollen is smooth and sticky so it can flow in the wind quicker.

R they don't have petals - instead they are dull green colours

ResultsPlus
Examiner Comments

This gains one mark for a correct statement about R.

Question 2 (c)(i)

In Q02(c)(i) candidates were asked to give an example of a natural method of asexual reproduction in plants.

Most candidates gave runners as their example but others correctly named bulbs, corms or rhizomes.

(c) Flowering plants can reproduce asexually.

(i) Give an example of a natural method of asexual reproduction in plants.

(1)

when a ~~bulb is~~ stem grows with a bulb from a plant which ~~is~~ & then falls to the ground ~~covered in soil.~~ and gets covered by soil.

ResultsPlus Examiner Comments

This gains one mark for bulbs.

release pollen

(c) Flowering plants can reproduce asexually.

(i) Give an example of a natural method of asexual reproduction in plants.

(1)

Runners

ResultsPlus Examiner Comments

This gains one mark for runners.

Question 2 (c)(ii)

In Q02(c)(ii) candidates were asked to give an example of an artificial method of asexual reproduction in plants.

Most candidates gave cuttings but credit was also given to other methods such as grafting, layering or tissue culture.

(ii) Give an example of an artificial method of asexual reproduction in plants.

(1)

cutting

ResultsPlus
Examiner Comments

This scores one mark.

(ii) Give an example of an artificial method of asexual reproduction in plants.

(1)

Cuttings

ResultsPlus
Examiner Comments

This scores one mark.

(ii) Give an example of an artificial method of asexual reproduction in plants.

(1)

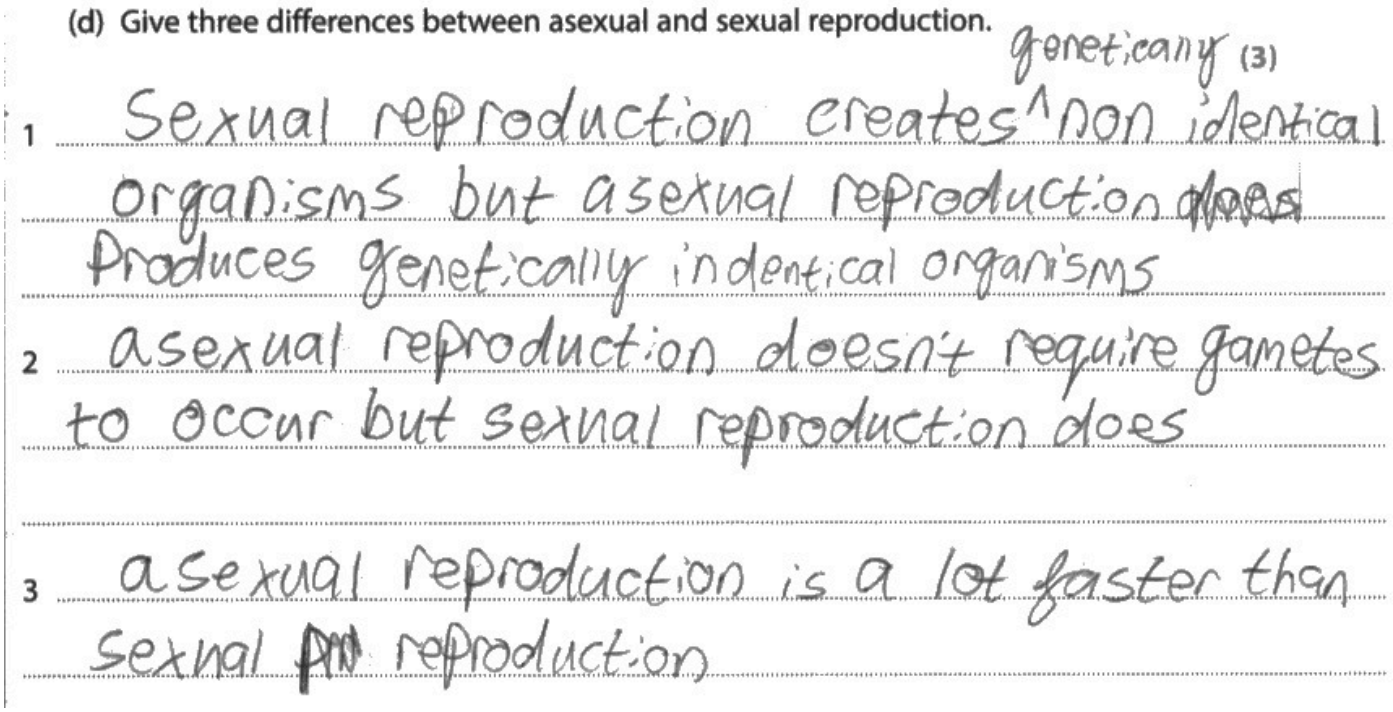
micropropagation

ResultsPlus
Examiner Comments

This scores one mark for micropropagation.

Question 2 (d)

In Q02(d) candidates were asked to give three differences between asexual and sexual reproduction. Many candidates gained full marks for reference to sexual reproduction requiring gametes, fertilisation and leading to genetic variation in the offspring. Credit was also given for asexual reproduction being faster.



(d) Give three differences between asexual and sexual reproduction. genetically (3)

1 Sexual reproduction creates ^non identical organisms but asexual reproduction does Produces genetically indentical organisms

2 asexual reproduction doesn't require gametes to occur but sexual reproduction does

3 asexual reproduction is a lot faster than sexual reproduction

ResultsPlus
Examiner Comments

This response gains full marks for reference to genetic variation in sexual reproduction, asexual not requiring gametes and asexual being a faster process.

(d) Give three differences between asexual and sexual reproduction.

(3)

1 Asexual reproduction does not involve gametes but sexual does.

2 Asexual reproduction only ever needs one organism, whereas sexual needs two

3 Asexual reproduction produces genetically identical offspring, sexual reproduction creates ~~natural~~ variation between organisms in the same species.

ResultsPlus
Examiner Comments

This response scores two marks for asexual does not involve gametes and produces genetically identical offspring.

ResultsPlus
Examiner Tip

Some candidates think that sexual reproduction requires two organisms even though they have studied sexual reproduction in flowering plants.

(d) Give three differences between asexual and sexual reproduction.

(3)

1 Sexual reproduction makes genetically varied offspring and asexual makes genetically identical offspring.

2 Sexual reproduction requires two organisms but asexual can have one

3 Sexual reproduction is slower and usually makes ~~fewer~~ less offspring.

ResultsPlus
Examiner Comments

This response also scores two marks for sexual makes genetically varied and sexual reproduction is slower.

(d) Give three differences between asexual and sexual reproduction.

(3)

1 Sexual includes male and female ~~rep~~ gametes.

2 Asexual is reproducing within the organism.

3 No variation in asexual.

ResultsPlus
Examiner Comments

This response scores one mark for reference to gametes in sexual reproduction.

ResultsPlus
Examiner Tip

References to variation need to specify genetic variation.

Question 2 (e)

Candidates were given the following information: A farmer has two varieties of a plant species.

One variety has a red flower colour and no scent.

The other variety has a white flower colour and a perfumed scent.

The farmer wants to produce a variety that has the red flower colour and the perfumed scent.

The candidates were asked to explain how the farmer could achieve this.

Many responses correctly described how selective breeding could be used to obtain red flowers with a perfumed scent.

Some candidates wrote about gene modification which did not fit with the context of the question.

(e) A farmer has two varieties of a plant species.

One variety has a red flower colour and no scent.

The other variety has a white flower colour and a perfumed scent.

The farmer wants to produce a variety that has the red flower colour and the perfumed scent.

Explain how the farmer could achieve this.

(3)

The farmer could achieve this by cross breeding the red flower with no scent with the white flower. The farmer should then select the offspring with red flowes that also have a perfumed set and cross breed these. They should repeat this over several generations to achieve a variety with both characteristics. Eventually these feetures will be predominat throughout the whole population.

ResultsPlus
Examiner Comments

This response gains full marks for explaining that the two varieties should be crossed and the offspring with red flowers and scent selected and bred. This is repeated for several generations.

(e) A farmer has two varieties of a plant species.

One variety has a red flower colour and no scent.

The other variety has a white flower colour and a perfumed scent.

The farmer wants to produce a variety that has the red flower colour and the perfumed scent.

Explain how the farmer could achieve this.

(3)

Take the variety with the best red flower colour and cross pollinate it with the other variety with the best scent. Select from their offspring the flowers with red flower colour and perfumed scent and cross pollinate them too. Repeat this process over many plant generations until many flowers are red and have a perfumed scent

ResultsPlus
Examiner Comments

This response also scores full marks.

(e) A farmer has two varieties of a plant species.

One variety has a red flower colour and no scent.

The other variety has a white flower colour and a perfumed scent.

The farmer wants to produce a variety that has the red flower colour and the perfumed scent.

Explain how the farmer could achieve this.

(3)

The farmer can selectively breed the red flower with the white flower with a perfumed scent. The farmer takes the desirable characteristics of the flower. The farmer then repeats this over many generations. The farmer breeds the offspring of the flower with of red flowers with perfumed scent.

ResultsPlus
Examiner Comments

This response scores full marks for reference to selective breeding, crossing the red and white flowers and breeding the offspring with red flowers and perfumed scent.

Question 3

Question 3 gave candidates a passage about the process used to produce yoghurt.

Candidates had to complete the passage by writing a suitable word or words in each blank space.

Most candidates were able to gain six or seven marks with lactose being the answer that fewest got correct.

3 The passage describes the process used to produce yoghurt.

Complete the passage by writing a suitable word or words in each blank space.

(7)

Yoghurt is made by heating milk to a high temperature.

This heating process is known as Sterilisation

This ensures that bacteria present in the liquid are dead.

The liquid is then cooled to between 40 °C and 46 °C.

A type of bacteria called lactobacillius is then added.

These bacteria use a sugar called lactose for

anaerobic respiration.

The pH of the yoghurt decreases because this respiration produces a substance called

lactic acid.

(Total for Question 3 = 7 marks)

ResultsPlus
Examiner Comments

This answer gained all seven marks.

3 The passage describes the process used to produce yoghurt.

Complete the passage by writing a suitable word or words in each blank space.

(7)

Yoghurt is made by heating milk to a high temperature.

This heating process is known as ~~fermentation~~ pasteurisation.

This ensures that bacteria present in the liquid are dead.

The liquid is then cooled to between 40 °C and 46 °C.

A type of bacteria called lactobacillus is then added.

These bacteria use a sugar called lactose for

aerobic respiration.

The pH of the yoghurt decreases because this respiration produces a substance called

lactic acid.

(Total for Question 3 = 7 marks)

ResultsPlus
Examiner Comments

This answer gained six marks with the second space being incorrect.

3 The passage describes the process used to produce yoghurt.

Complete the passage by writing a suitable word or words in each blank space.

(7)

Yoghurt is made by heating ..milk.. to a high temperature.

This heating process is known as ..... .

This ensures that bacteria present in the liquid are ..dead.. .

The liquid is then cooled to between 40 °C and 46 °C.

A type of bacteria called ..... is then added.

These bacteria use a sugar called ..yeast.. for

..anaerobic.. respiration.

The pH of the yoghurt decreases because this respiration produces a substance called

..lactic acid.. .

(Total for Question 3 = 7 marks)

ResultsPlus
Examiner Comments

This response gained four marks with correct words being: milk, dead, anaerobic and lactic acid.

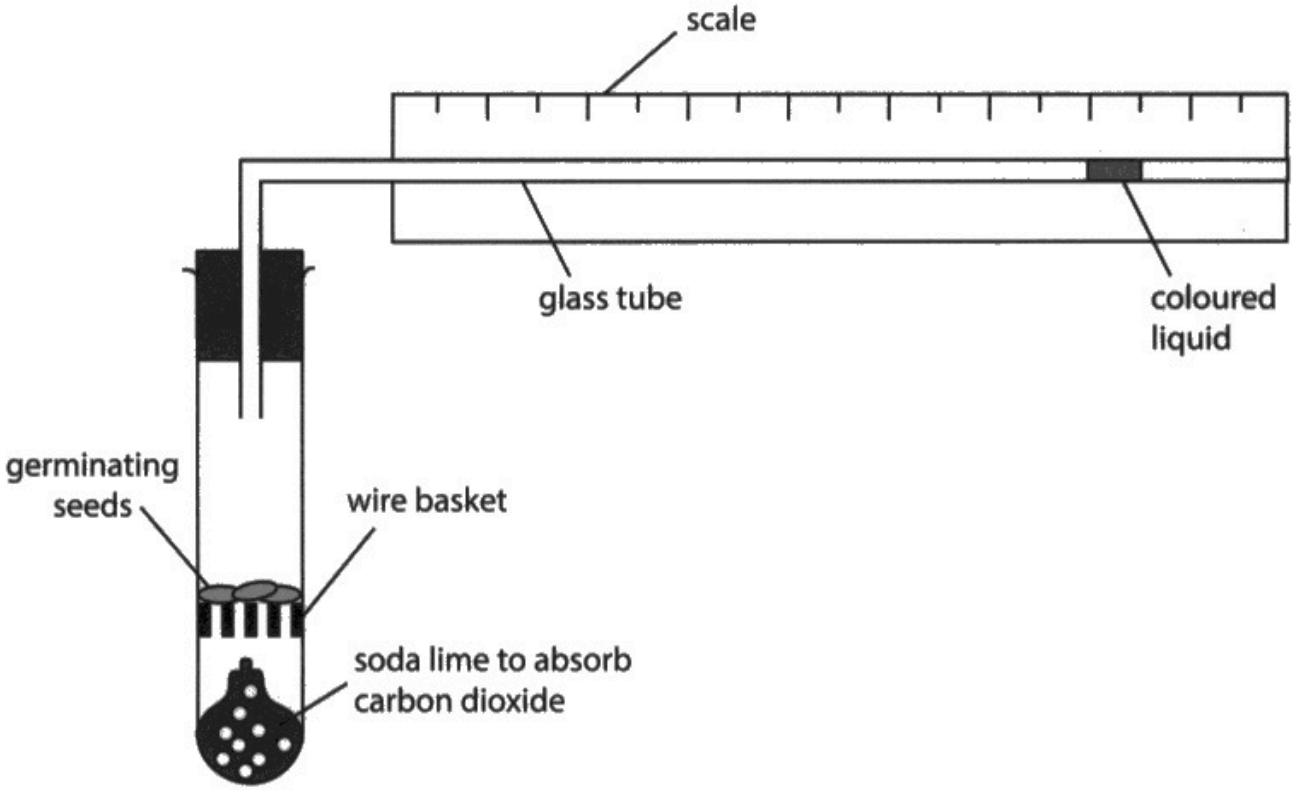
Question 4 (a)

Question 4 showed a diagram of a respirometer which is a simple apparatus that can be used to measure the rate of respiration in small organisms. A student uses the respirometer to investigate the rate of respiration in some germinating seeds.

In Q04(a) most candidates could give the balanced chemical symbol equation for aerobic respiration.

4 A respirometer is a simple apparatus that can be used to measure the rate of respiration in small organisms.

A student uses the respirometer to investigate the rate of respiration in some germinating seeds. NOW.



(a) Give the balanced chemical symbol equation for aerobic respiration. **(2)**

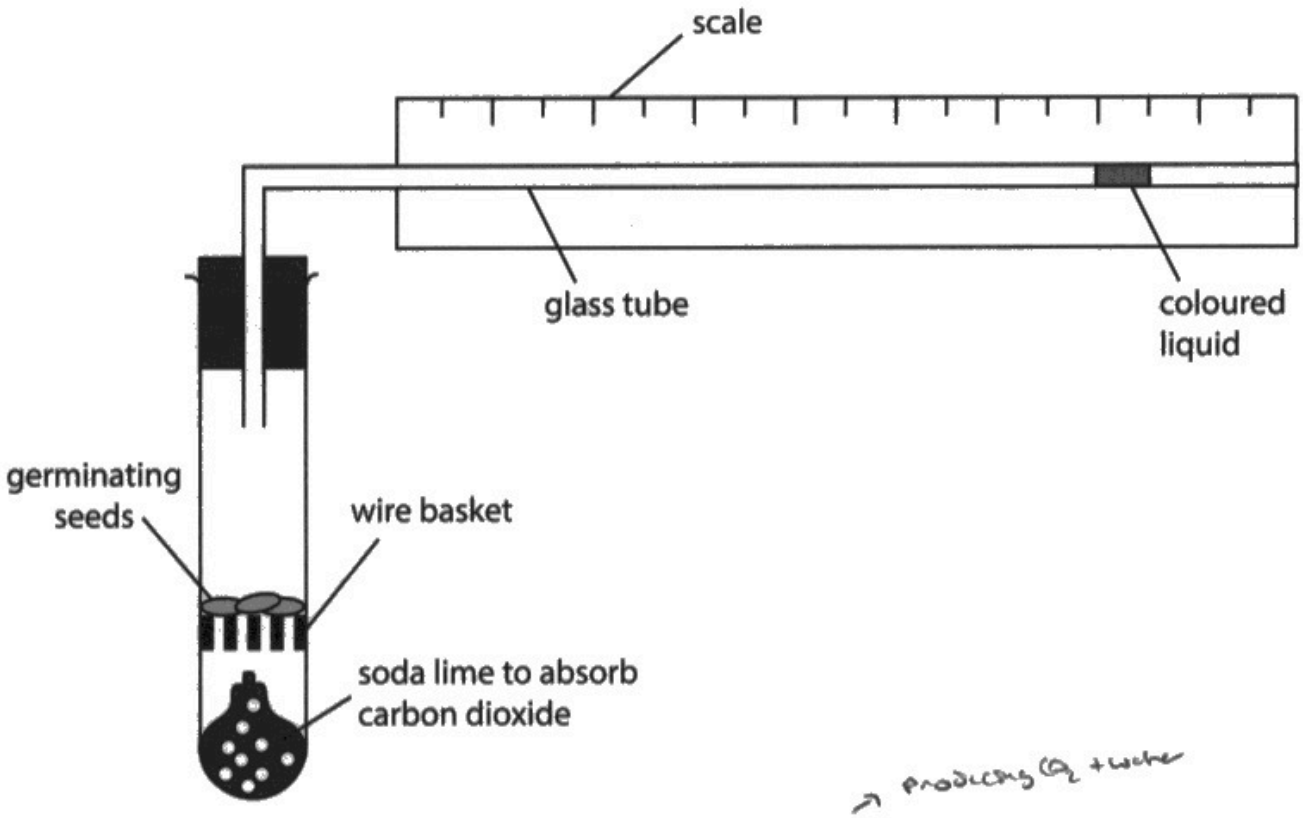
$C_6H_{12}O_6 + 6O_2 \longrightarrow 6H_2O + 6CO_2$

ResultsPlus
Examiner Comments

This response gains both marks for correct formulae and correct balancing.

4 A respirometer is a simple apparatus that can be used to measure the rate of respiration in small organisms.

A student uses the respirometer to investigate the rate of respiration in some germinating seeds.



(a) Give the balanced chemical symbol equation for aerobic respiration.

(2)

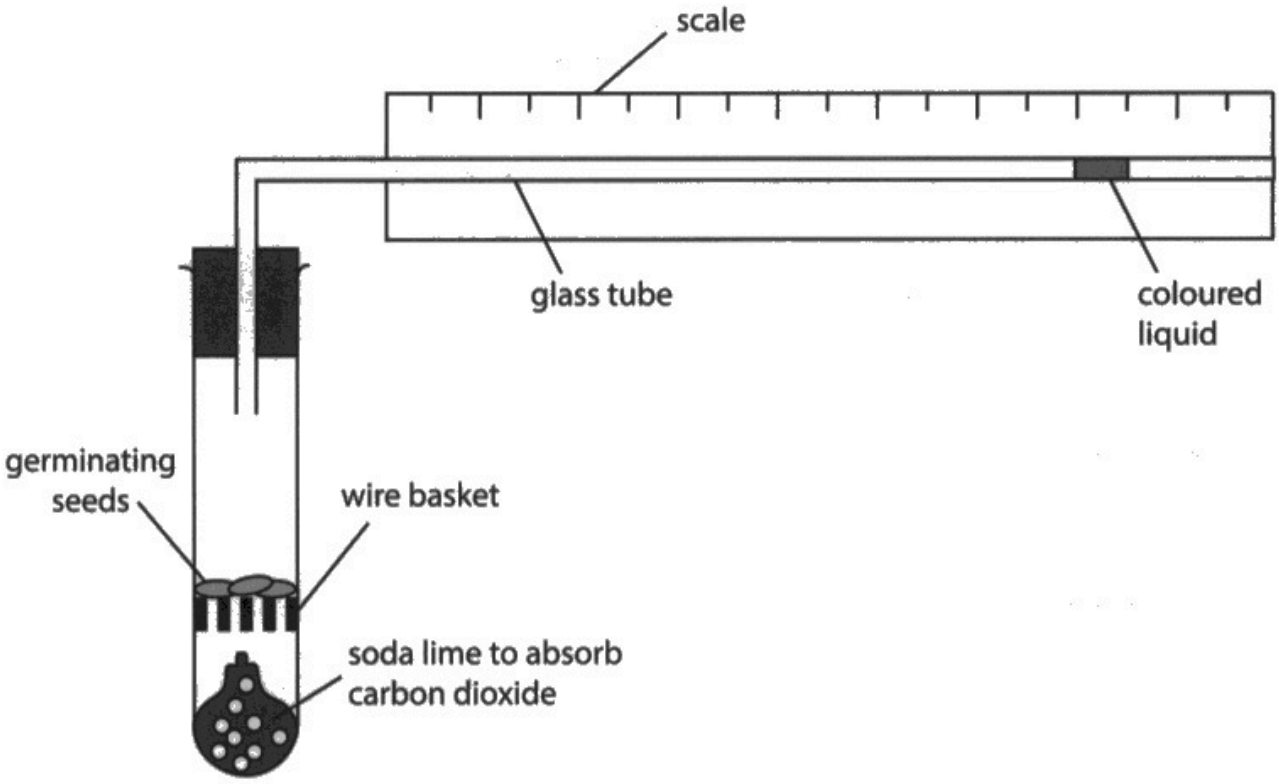
$6O_2 + C_6H_{12}O_6 \rightarrow 6CO_2 + 6H_2O$

ResultsPlus
Examiner Comments

This response also gains both marks for correct formulae and correct balancing.

4 A respirometer is a simple apparatus that can be used to measure the rate of respiration in small organisms.

A student uses the respirometer to investigate the rate of respiration in some germinating seeds.



(a) Give the balanced chemical symbol equation for aerobic respiration.

(2)

$6C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

ResultsPlus
Examiner Comments

This response gains one mark for correct formulae but balancing is incorrect.

Question 4 (b)(i)

In Q04(b)(i) candidates were asked to explain why carbon dioxide needs to be absorbed by the soda lime when measuring the rate of aerobic respiration. Most candidates gained at least one mark with the best responses explaining that respiration releases carbon dioxide. Therefore the bubble would not move unless this carbon dioxide is removed so only oxygen consumption is measured.

(b) The student measures the rate of respiration of 10 g of germinating seeds at 20 °C.

They then repeat this with another sample of 10 g of germinating seeds at 30 °C.

The rate of respiration can be measured by recording the distance, in mm, the bubble of coloured liquid moves on the scale in one minute.

They measure the rate three times at each temperature.

(i) Explain why carbon dioxide needs to be absorbed by the soda lime when measuring the rate of aerobic respiration.

(2)

so we can see how much oxygen is used up as carbon dioxide is a product of respiration it needs to be absorbed so seeds can continue to respire

ResultsPlus
Examiner Comments

This response scores full marks for explaining that we can see how much oxygen is used up and reference to carbon dioxide being produced by respiration.

(b) The student measures the rate of respiration of 10 g of germinating seeds at 20 °C.

They then repeat this with another sample of 10 g of germinating seeds at 30 °C.

The rate of respiration can be measured by recording the distance, in mm, the bubble of coloured liquid moves on the scale in one minute.

They measure the rate three times at each temperature.

(i) Explain why carbon dioxide needs to be absorbed by the soda lime when measuring the rate of aerobic respiration.

(2)

So that the germinating seeds will aerobically respire rather than photosynthesise with the carbon dioxide.

ResultsPlus
Examiner Comments

This does not gain any credit.

ResultsPlus
Examiner Tip

Candidates should remember that this item is about respiration and that seeds do not carry out photosynthesis.

Question 4 (b)(ii)

In Q04(b)(ii) most candidates were able to state how the student could have changed the temperature in this investigation. Most referred to or explained how they would use a water bath.

(ii) State how the student could have changed the temperature in this investigation.

(1)

place the boiling tube in a waterbath and alter the temperature with mat

ResultsPlus
Examiner Comments

This scores one mark.

(ii) State how the student could have changed the temperature in this investigation.

(1)

Use water bath.

ResultsPlus
Examiner Comments

This also scores one mark.

(ii) State how the student could have changed the temperature in this investigation.

(1)

By using a Bunsen burner, to heat the ~~bottom~~ test tube.
(By insulating the test tube so that less heat will be lost)

ResultsPlus
Examiner Comments

No credit for using a Bunsen burner.

(ii) State how the student could have changed the temperature in this investigation.

(1)

Using a beaker filled with water of the ~~req~~ required temperature, and a thermometer.

ResultsPlus
Examiner Comments

This scores one mark for a description of a water bath.

Question 4 (c)(i)

In Q04(c)(i) almost all candidates were able to calculate the mean distance moved by the bubble at 30 °C.

(c) The table shows the student's results.

Temperature in °C	Distance moved by bubble in one minute in mm			
	reading 1	reading 2	reading 3	mean
20	14	12	14	13
30	22	25	24	

(i) Calculate the mean distance moved by the bubble at 30 °C.

(2)

22 + 25 + 24 = 71

$\frac{71}{3}$ = 23.67

23.7

mean distance = 24 mm

ResultsPlus
Examiner Comments

This scores both marks for the correct answer.

(c) The table shows the student's results.

Temperature in °C	Distance moved by bubble in one minute in mm			
	reading 1	reading 2	reading 3	mean
20	14	12	14	13
30	22	25	24	23

(i) Calculate the mean distance moved by the bubble at 30 °C.

(2)

22 + 25 + 24

3

mean distance = 23.66 mm

ResultsPlus
Examiner Comments

This response scores one mark for dividing by 3.

ResultsPlus
Examiner Tip

The candidate got the final answer incorrect, due to a rounding error, but gained one mark for their working.

Question 4 (c)(ii)

In Q04(c)(ii) candidates were asked to explain the effect of increasing the temperature on the movement of the bubble. Almost all candidates gained some credit, with the best responses explaining that increased kinetic energy will lead to increased collisions between enzyme and substrate molecules, increasing the rate of respiration and the absorption of oxygen. Credit was also given for reference to enzyme's optimum temperature.

(ii) Explain the effect of increasing the temperature on the movement of the bubble.

(3)

Increasing the temperature increases the distance moved by the bubble (in mm per minute). This is because, increasing the temperature increases the rate of ~~germination~~ respiration, as there are more active site - substrate collisions in a shorter period of time: higher frequency of collisions. So, more oxygen is used up in the respiration reaction and so the volume of oxygen inside both the glass tube and the test tube decreases, causing the bubble to move further to the left.

ResultsPlus
Examiner Comments

This response scores all three marks for explaining that the rate of respiration increases, that there are more collisions and that more oxygen is used.

(ii) Explain the effect of increasing the temperature on the movement of the bubble.

(3)

Increasing the temperature means the distance moved by the bubble also increases in one minute. This is because the higher temperature means the gases and enzymes involved in respiration at the seed have more kinetic energy so they move around more and therefore at optimum temperature (only for enzymes), they do more - overall respiration takes place. More respiration taking place also means the water vapour ~~produced~~ produced, so the liquid or bubble is moved more. ~~by the seed vapour produced.~~ It moves more distance in one minute therefore.

(Total for Question 4 = 10 marks)

ResultsPlus
Examiner Comments

This response gains three marks for explaining that kinetic energy increases, that more respiration takes place and that enzymes are at the optimum temperature.

(ii) Explain the effect of increasing the temperature on the movement of the bubble.

(3)

As temperature increased, the distance moved by the bubble also increased. This is because temperature increases the kinetic energy of particles which can collide more frequently. This increases the rate of reaction - respiration in enzymes.

ResultsPlus
Examiner Comments

This response also gains three marks. Increased kinetic energy, increased frequency of collisions and therefore increased rate of respiration.

ResultsPlus
Examiner Tip

This response explains the reason for the change in bubble movement. Some responses merely described the change.

Question 5 (a)(ii)

Question 5 was about greenhouse gases. In Q05(a)(ii) candidates were asked to explain what is meant by the term greenhouse effect.

(ii) Explain what is meant by the term **greenhouse effect.**

(2)

The greenhouse ~~gases~~ gases reflect longer-wavelength frequencies of EM radiation (originating from the sun) back to earth after they have reflected off of the surface of the earth and are attempting to leave the atmosphere. The trapping of infrared radiation contributes to global warming.

ResultsPlus
Examiner Comments

This response gains both marks for explaining that greenhouse effect is the trapping of infra-red radiation leading to global warming.

(ii) Explain what is meant by the term **greenhouse effect.**

(2)

It is when gases absorb and trap light energy from the sun and keeps it in our atmosphere, keeping the Earth warm.

ResultsPlus
Examiner Comments

This answer scores one mark for reference to keeping earth warm. No credit for trapping light.

(ii) Explain what is meant by the term **greenhouse effect.**

(2)

The greenhouse effect is what occurs when greenhouse gases like the CFC's and Carbon dioxide are released into the environment by burning substance or other reasons.

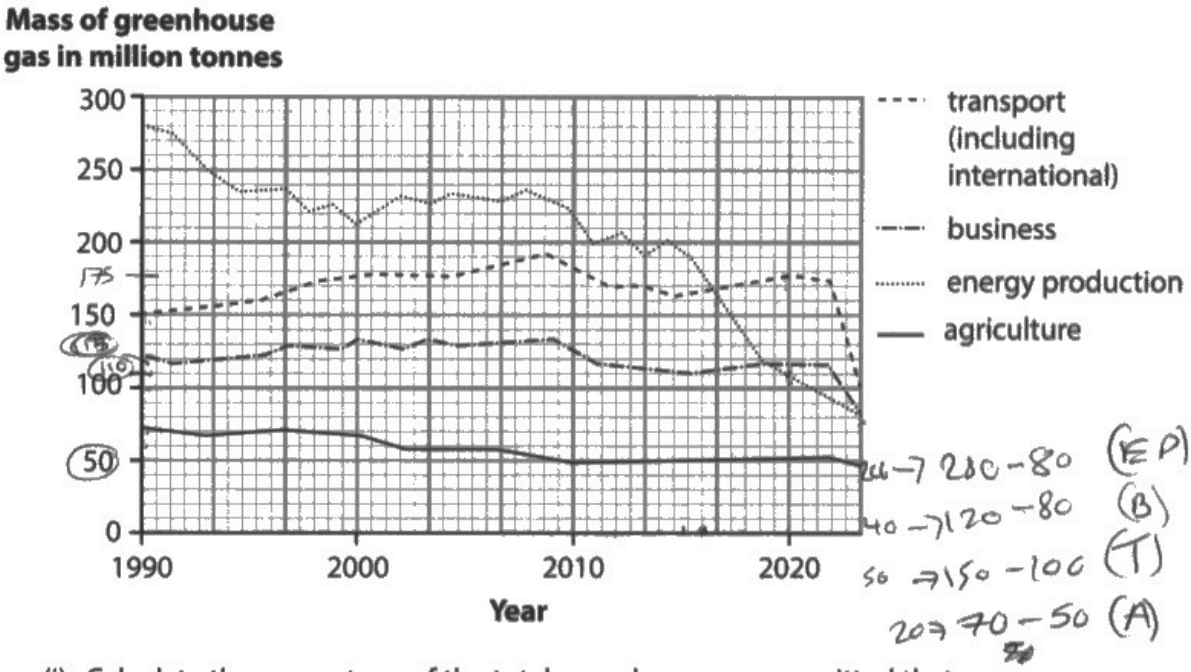
ResultsPlus
Examiner Comments

This response does not gain any marks as it describes greenhouse gases but does not explain the greenhouse effect.

Question 5 (b)(i)

In Q05(b)(i) candidates were asked to calculate the percentage of the total greenhouse gases emitted that came from energy production in 2020. Most candidates gained full marks for correctly calculating the percentage and those who did not often scored a mark for a stage in their working.

(b) The graph shows the mass of greenhouse gases emitted from four sources in the United Kingdom from 1990 to 2020.



(i) Calculate the percentage of the total greenhouse gases emitted that came from energy production in 2020.

(3)

$175 + 115 + 110 + 50 = 450$

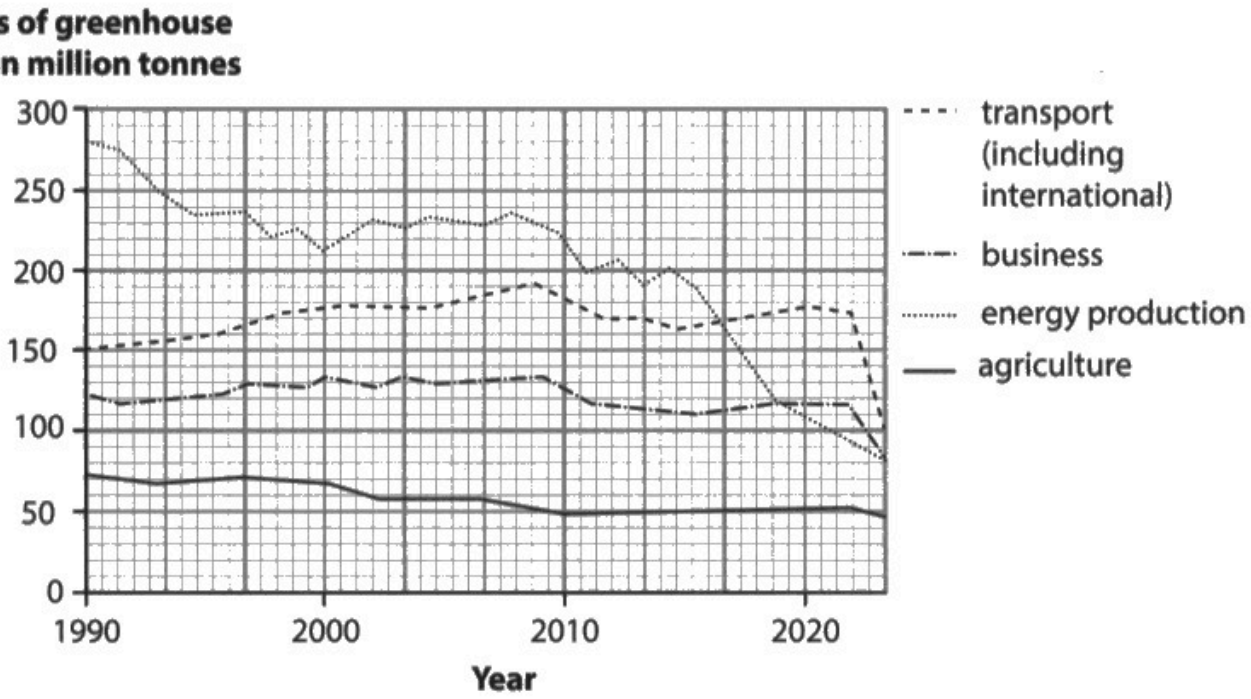
$\frac{110}{450} = 0.24 = 24$

percentage = 24 %

ResultsPlus Examiner Comments

This answer scored full marks for the correct calculation.

(b) The graph shows the mass of greenhouse gases emitted from four sources in the United Kingdom from 1990 to 2020.



(i) Calculate the percentage of the total greenhouse gases emitted that came from energy production in 2020.

(3)

110

180 + 100 + 50

110 ÷ (175 + 115 + 50) × 100 =

$\frac{110}{340} \times 100 = \frac{550}{17} = 32.35...$

percentage = 32.4 %

ResultsPlus
Examiner Comments

This response did not get the correct answer but picked up a mark for a stage in their working of dividing 110 by their total.

ResultsPlus
Examiner Tip

Candidates are reminded to always show the stages in their calculations.

Question 5 (b)(ii)

This question was the first of the longer extended prose evaluative type items. Candidates were asked to comment on the changes in the four sources of greenhouse gases from 1990 to 2020. They were told to use the information in the graph and their own knowledge to support their answer. Almost all candidates gained at least three marks with many gaining full credit. The mark scheme details the points credited which included a comment about the change in a source of gases and a reason for that change.

(ii) Comment on the changes in the four sources of greenhouse gases from 1990 to 2020.

Use the information in the graph and your own knowledge to support your answer.

(5)

Since Since 1990, there has been a net decrease in Greenhouse Gas emissions from energy production. This could be due to an increased reliance on Carbon-neutral ~~renewable~~ renewable sources. Both transport and business ~~we~~ were fairly steady from 1990 to about 2022, and then they have both decreased greatly, possibly due to efforts by many nations to take more ~~environmental~~ environmentally-friendly transport, such as an increase in electric cars / buses and trains. ~~Agriculture has remained fairly constant~~ but more likely to do with the COVID-19 pandemic, and the decrease in travel during lockdown. Agriculture did not experience this reduction and so has remained fairly constant since 1990, gradually decreasing ~~the whole time throughout~~ the whole period.

ResultsPlus
Examiner Comments

This response scores all five marks. It notes the fall in gases from energy production and gives a reason for this. It also notes the fall in transport and in business and suggests a reason. It also notes a fall in the gases from agriculture.

(ii) Comment on the changes in the four sources of greenhouse gases from 1990 to 2020.

Use the information in the graph and your own knowledge to support your answer.

(5)

Energy production has decreased since 1990 to 2020, with a few fluctuations. this may be due to the increased use of renewable energy in households and industry ~~since to~~ compared to 1990. this may including solar panels, due to their reliability. Trasport has slightly increased from 1990 to 2020, which may be due to more individuals obtaining vehicles and driving. ~~However~~, Busines began in 1990 at 120 million tones, and then increased, but decreased down to 150 million tonnes by 2020. This ~~was~~ shows that business has remained constant, including factories, which emit large quantities of greenhouse gases. In agriculture, it began with 70 million tonnes in 1990, and ^gradually decreased until it remained ^approximately constant from 2010 to 2020, at 50 million tones. This may be because farmers now use manure for crop growth, opposed to ~~the~~ other fertilizers used in 1990, that may have released and produced a higher mass of greenhouse gas in million tonnes.

ResultsPlus
Examiner Comments

This response also gains full marks. It includes the decrease in gases from energy and the reason for the change. It describes the increase in transport up to 2020 and the reason for this. It also correctly notes the changes in business and agriculture.

Question 6 (a)(iii)

In question 6 candidates were told that a student uses this apparatus to investigate the effect of light intensity on the rate of photosynthesis in pondweed.

In Q06(a)(iii) almost all responses could correctly give one abiotic variable the student should control in this investigation.

(iii) Give one abiotic variable the student should control in this investigation.

(1)

Temperature

ResultsPlus
Examiner Comments

Temperature scores one mark.

(iii) Give one abiotic variable the student should control in this investigation.

(1)

~~The strength of the lamp~~ The same lamp.

ResultsPlus
Examiner Comments

Using the same lamp also scores one mark.

Question 6 (b)(i)

In Q06(b)(i) candidates had to plot a line graph to show the relationship between the distance of the lamp from the beaker and the mean number of bubbles released. Most graphs gained full marks with the most common error being failure to include 'per minute' in the units for the y axis.

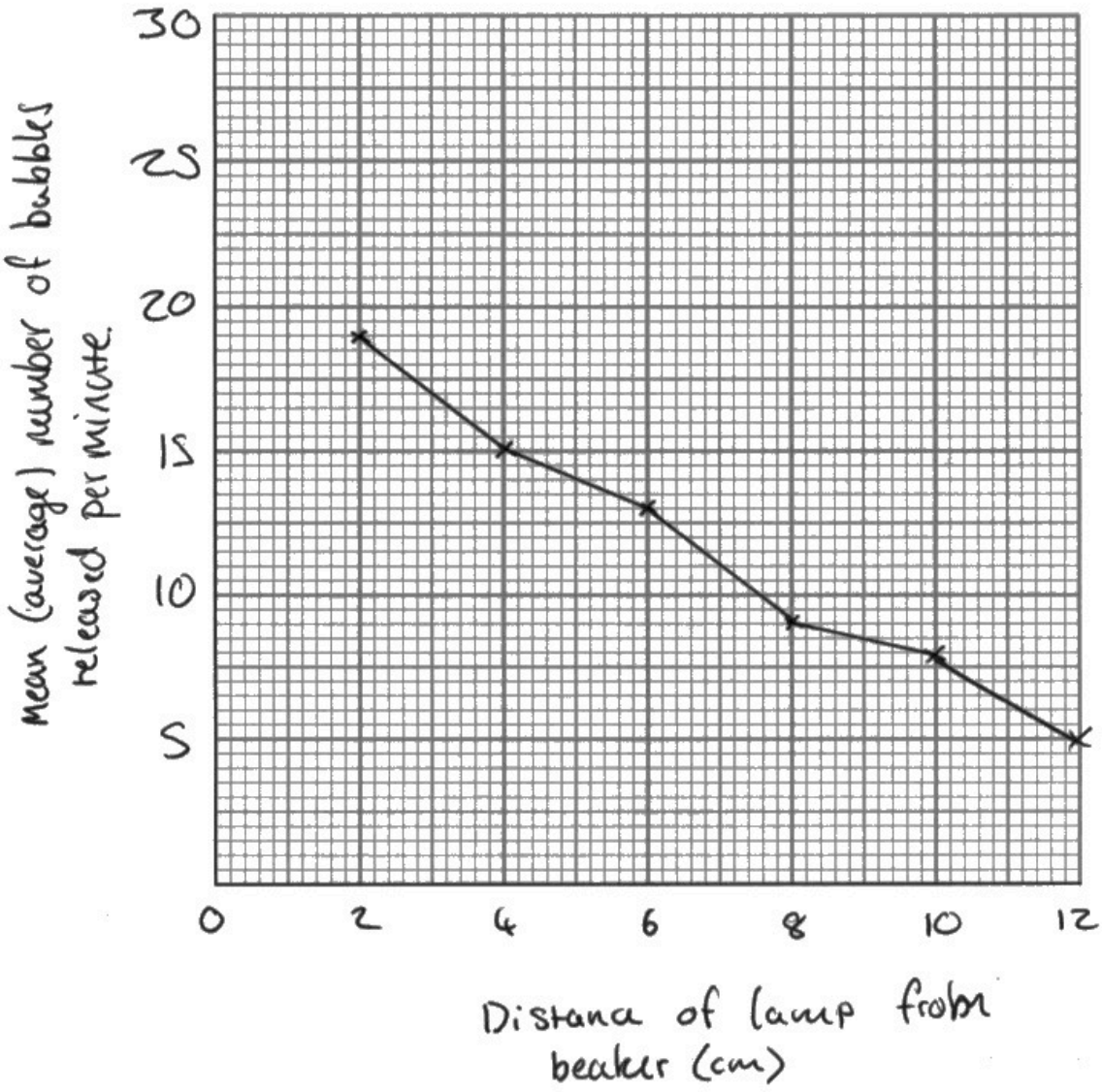
(b) The table shows the student's results

Distance of lamp from beaker in cm	Number of bubbles released per minute			
	count 1	count 2	count 3	mean (average)
2	20	18	20	19
4	16	15	15	15
6	12	14	13	13
8	10	9	8	9
10	8	7	8	8
12	5	6	4	5

(i) Plot a line graph to show the relationship between the distance of the lamp from the beaker and the mean number of bubbles released.

Use a ruler to join your points with straight lines.

(5)



ResultsPlus
Examiner Comments

This graph scores full marks.

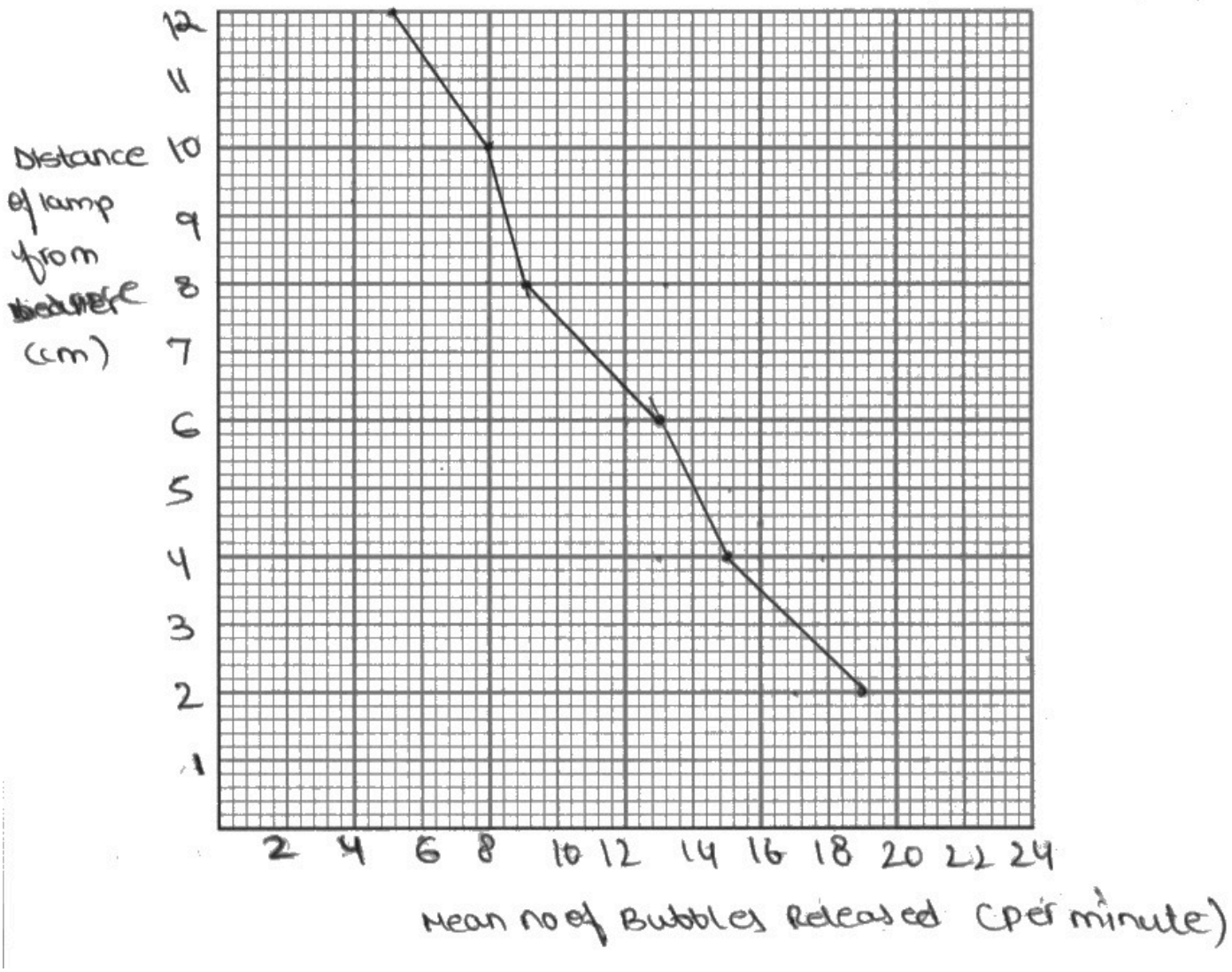
(b) The table shows the student's results

Distance of lamp from beaker in cm	Number of bubbles released per minute			
	count 1	count 2	count 3	mean (average)
2	20	18	20	19
4	16	15	15	15
6	12	14	13	13
8	10	9	8	9
10	8	7	8	8
12	5	6	4	5

(i) Plot a line graph to show the relationship between the distance of the lamp from the beaker and the mean number of bubbles released.

Use a ruler to join your points with straight lines.

(5)



ResultsPlus
Examiner Comments

This scores four marks as the axes are the wrong way around.

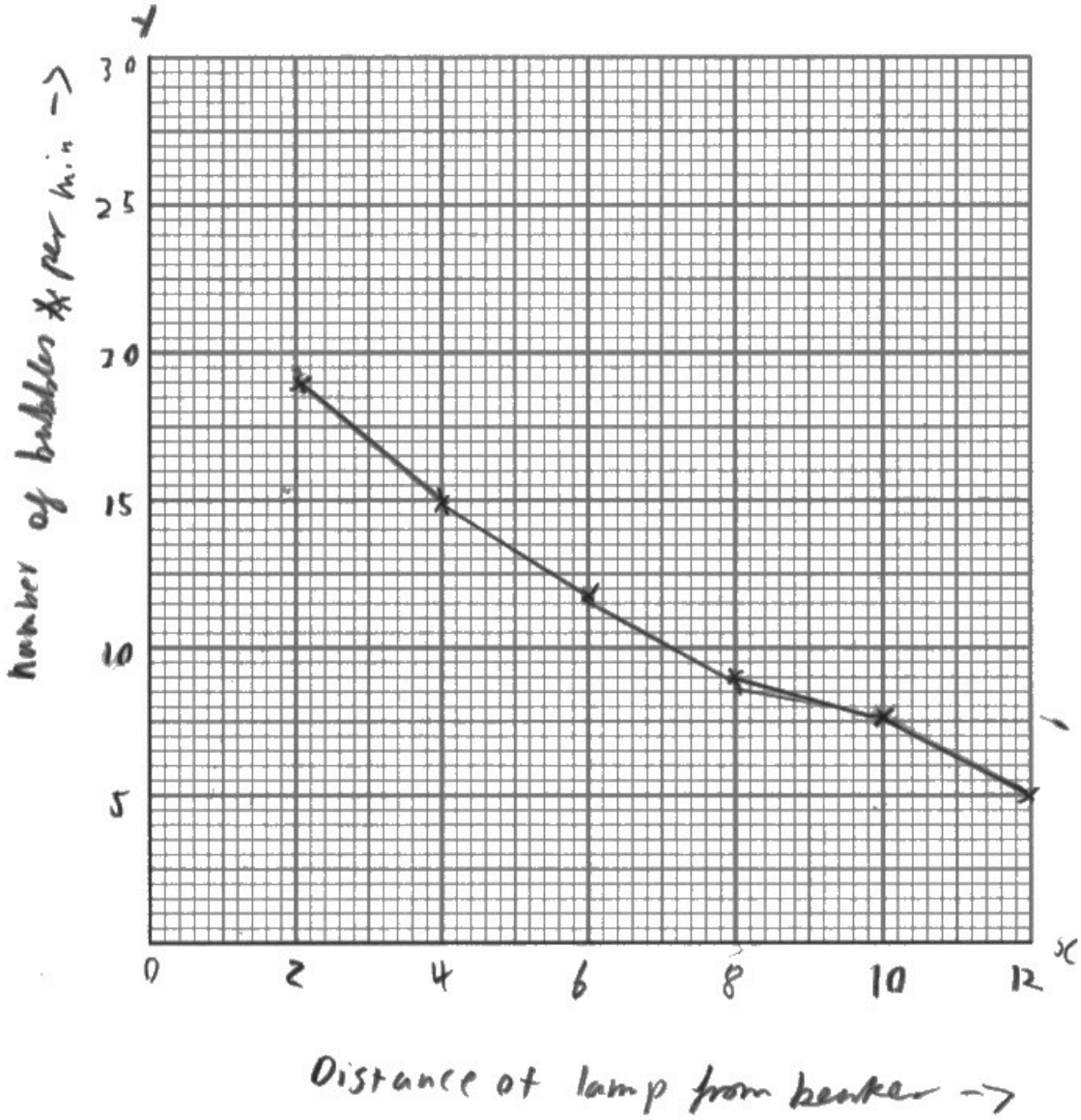
(b) The table shows the student's results

Distance of lamp from beaker in cm	Number of bubbles released per minute			
	count 1	count 2	count 3	mean (average)
2	20	18	20	19
4	16	15	15	15
6	12	14	13	13
8	10	9	8	9
10	8	7	8	8
12	5	6	4	5

(i) Plot a line graph to show the relationship between the distance of the lamp from the beaker and the mean number of bubbles released.

Use a ruler to join your points with straight lines.

(5)



ResultsPlus
Examiner Comments

This graph gains three marks as no units are present on the x axis and one point for 10 cm is not plotted correctly.

Question 6 (b)(ii)

In Q06(b)(ii) candidates were asked to explain the effect of increasing the distance of the lamp from the beaker on the mean number of bubbles released per minute. Most candidates were able to gain full marks for explaining that as distance increases the light intensity reduces so slower rate of photosynthesis and fewer bubbles of oxygen are released.

(ii) Explain the effect of increasing the distance of the lamp from the beaker on the mean number of bubbles released per minute.

(3)

As the distance ~~from the~~ of lamp from the beaker increases number of bubbles released decreases as less light intensity less photosynthesis so less bubbles produced. When the distance was 2 cm number of bubbles released were 19 and when it was 12 cm away the bubble produced ~~s~~ were 5. ~~Repeat this~~ investigation Temperature of water and size of pondweed is not mentioned.

ResultsPlus
Examiner Comments

This gains three marks for number of bubbles reducing due to less light intensity, leading to less photosynthesis.

(ii) Explain the effect of increasing the distance of the lamp from the beaker on the mean number of bubbles released per minute.

(3)

- increase in distance of lamp from beaker decreases number of bubbles released per minute
- less light energy is absorbed by the chlorophyll
- ~~less~~ slower rate of photosynthesis
- less bubbles of O_2 gas produced

ResultsPlus
Examiner Comments

This also gains three marks for explaining that less light energy is absorbed, a slower rate of photosynthesis so less oxygen bubbles produced.

(ii) Explain the effect of increasing the distance of the lamp from the beaker on the mean number of bubbles released per minute.

(3)

The closer the lamp, the stronger the light intensity meaning the plant recieves more light which it can use to photosynthesise, ~~the~~ photosynthesis releases oxygen gas which are the bubbles seen in the reaction meaning a higher rate of photosynthesis means more bubbles per minute.

ResultsPlus
Examiner Comments

This gains two marks for higher light intensity increasing rate of photosynthesis as converse allowed for marking points two and three.

Question 7 (a)

In Q07(a) many responses could correctly give three differences in structure between red blood cells and white blood cells.

7 (a) Human blood contains red blood cells and white blood cells.

Give three differences in structure between red blood cells and white blood cells.

(3)

1 red blood cells don't have a nucleus, white blood cells do

2 red blood cells are biconcave, white blood cells are not

3 red blood cells are small in size, white blood cells are larger in size

ResultsPlus
Examiner Comments

This response gains three marks for noting red blood cells have no nucleus, red blood cells are biconcave and red blood cells are smaller.

7 (a) Human blood contains red blood cells and white blood cells.

Give three differences in structure between red blood cells and white blood cells.

(3)

1 red blood cells are bioconcave

2 red blood cells are smaller

3 red blood cells don't have a nucleus white blood cells do.

ResultsPlus
Examiner Comments

This response also gains three marks.

7 (a) Human blood contains red blood cells and white blood cells.

Give three differences in structure between red blood cells and white blood cells.

(3)

1 White blood cells have a nucleus, but red blood cells do not.

2 White blood cells are spherical, but red blood cells are biconcave.

3 Red blood cells ~~are~~ contain haemoglobin, but white blood cells do not.

ResultsPlus
Examiner Comments

This response also gains three marks for white blood cells have a nucleus, red blood cells are biconcave and red blood cells contain haemoglobin.

Question 7 (b)(i)

Question 7(b) gave candidates data from men and women living at different altitudes with the mean mass of haemoglobin in one litre of blood and the mean number of red blood cells in one litre of blood.

In Q07(b)(i) candidates were told that the blood volume of a woman living at an altitude of 1890m is 4.3 litres. They then had to calculate the total number of red blood cells in this person and give the answer in standard form.

Most responses earned full marks with those that failed to gain full marks often gaining some credit for their working.

(b) Scientists collect data from men and women living at different altitudes.

The scientists determine

- the mean mass of haemoglobin in one litre of blood
- the mean number of red blood cells in one litre of blood

The table gives the scientists' results.

Altitude in m	Mean mass of haemoglobin in 1 litre of blood in g		Mean number of red blood cells in 1 litre × 10^{12}		Number of people in sample	
	men	women	men	women	men	women
0 (sea level)	148	138	5.15	4.84	18 453	27 559
1890	152	147	5.37	5.20	2175	3510
2270	151	142	5.18	4.88	2023	2943

(i) The blood volume of a woman living at an altitude of 1890 m is 4.3 litres.

Calculate the total number of red blood cells in this person.

Give your answer in standard form.

(3)

1 litre = 5.2×10^{12}

4.3 litre = 2.236×10^{13}

number of red blood cells = 2.236×10^{13}

ResultsPlus
Examiner Comments

This response gains full marks for the correct answer written in standard form.

(b) Scientists collect data from men and women living at different altitudes.

The scientists determine

- the mean mass of haemoglobin in one litre of blood
- the mean number of red blood cells in one litre of blood

The table gives the scientists' results.

Altitude in m	Mean mass of haemoglobin in 1 litre of blood in g		Mean number of red blood cells in 1 litre × 10^{12}		Number of people in sample	
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1890	152	147	5.37	5.20	2175	3510
2270	151	142	5.18	4.88	2023	2943

(i) The blood volume of a woman living at an altitude of 1890 m is 4.3 litres.

Calculate the total number of red blood cells in this person.

Give your answer in standard form.

(3)

$\frac{5200000000000}{2145\ 3510} = 148148148|$

$\frac{5.2 \times 10^{12} \times 4.3}{3510} = 6370370370$

number of red blood cells = 6.37037037×10^{9}

ResultsPlus
Examiner Comments

This response does not have the correct answer but gains one mark for multiplying by 5.2 in their working.

Question 7 (b)(ii)

In this item candidates had to calculate the percentage difference in mean mass of haemoglobin in 1 litre of blood in men living at 2270 m compared with men living at sea level. Most responses gained some credit, with the best gaining both marks for correctly using the mass of haemoglobin at sea level as the comparator.

(ii) Calculate the percentage difference in mean mass of haemoglobin in 1 litre of blood in men living at 2270 m compared with men living at sea level.

(2)

$\frac{151}{148} \times 100 = 102.027...$

$102.027 - 100 = 2.027...$

$= 2$

percentage difference = 2.027 %

ResultsPlus
Examiner Comments

This response correctly calculated the percentage.

(ii) Calculate the percentage difference in mean mass of haemoglobin in 1 litre of blood in men living at 2270 m compared with men living at sea level.

(2)

$\frac{3}{151} \times 100 =$

2.0

percentage difference = [redacted] %

ResultsPlus
Examiner Comments

This response uses the wrong comparator when dividing by 151 rather than 148. However it does score one mark for 3 in the working.

Question 7 (b)(iii)

This item is the second evaluative response on this paper. Candidates were asked to discuss the relationship between altitude and mean mass of haemoglobin in 1 litre of blood and the number of red cells in 1 litre of blood in men and women. They were told to use the data in the table and their own knowledge in their answer. This item was very well answered by most candidates with many gaining full credit.

(iii) Discuss the relationship between altitude and mean mass of haemoglobin in 1 litre of blood and the number of red cells in 1 litre of blood in men and women.

Use the data in the table and your own knowledge in your answer.

(5)

The greater the altitude, the greater the number of red blood cells per litre and the greater the mass of haemoglobin in 1 litre of blood as air is thinner at higher altitude, there there is less O_2 for respiration, so the body makes more red blood cells and haemoglobin to transport enough O_2 to cells in body for aerobic respiration.

There is more red blood cells per litre and mass of haemoglobin per litre in men than women, may be because men are generally taller and they have more cells. that need O_2* for respiration and CO_2 removed, there they men need more red blood cells to carry O_2 to cells and CO_2 away.

* cells need O_2

This response scores full marks. It discusses the increase in red blood cells and haemoglobin with altitude. It notes that at altitude there is less oxygen available so more haemoglobin enables transport of oxygen for respiration. It also notes that men have more haemoglobin and more red cells than women.

(iii) Discuss the relationship between altitude and mean mass of haemoglobin in 1 litre of blood and the number of red cells in 1 litre of blood in men and women.

Use the data in the table and your own knowledge in your answer.

(5)

- ~~Women~~ The table suggests women have an overall lower number of red blood cells and mass of haemoglobin.

- for both men and women the mean mass of haemoglobin ~~and mean number of red blood cells~~ increase the higher the altitude

- The mean red blood cells have an altitude at which there are the most, 1890.

- The increase in both ~~mass~~ of haemoglobin and number of red blood cells increase ~~by~~ at greater rates in women

- However ~~more~~ a much greater number of women wer sampled compared to the men

ResultsPlus
Examiner Comments

This response gains four marks. It notes that women have lower numbers of red cells and lower mass of haemoglobin than men. It states that the number of red cells and haemoglobin increase with altitude. It also notices that there are more women in the sample than men.

Question 8 (a)

Question 8 is about cystic fibrosis (CF), a condition that affects the mucus produced in the lungs and in other organs.

The condition is caused by a recessive allele. In Q08(a) candidates were asked to state what is meant by a recessive allele. Most responses gained the mark by stating that a recessive allele is only expressed in the homozygote.

8 Cystic fibrosis (CF) is a condition that affects the mucus produced in the lungs and in other organs.

The condition is caused by a recessive allele.

(a) State what is meant by a recessive allele.

(1)

2 copies of allele are required in genotype to be expressed in phenotype.
only expressed if both present

ResultsPlus Examiner Comments

This scores the mark.

8 Cystic fibrosis (CF) is a condition that affects the mucus produced in the lungs and in other organs.

The condition is caused by a recessive allele.

(a) State what is meant by a recessive allele.

(1)

An allele which is only expressed in phenotype
both alleles are recessive and not expressed in phenotype
when with a dominant allele but still carried

ResultsPlus Examiner Comments

This also scores the mark.

8 Cystic fibrosis (CF) is a condition that affects the mucus produced in the lungs and in other organs.

The condition is caused by a recessive allele.

(a) State what is meant by a recessive allele.

(1)

needs to be homozygous in order to be expressed.

This also scores the mark.

8 Cystic fibrosis (CF) is a condition that affects the mucus produced in the lungs and in other organs.

The condition is caused by a recessive allele.

(a) State what is meant by a recessive allele.

(1)

Type of genotype ~~[illegible]~~ individuals and phenotype of the offspring

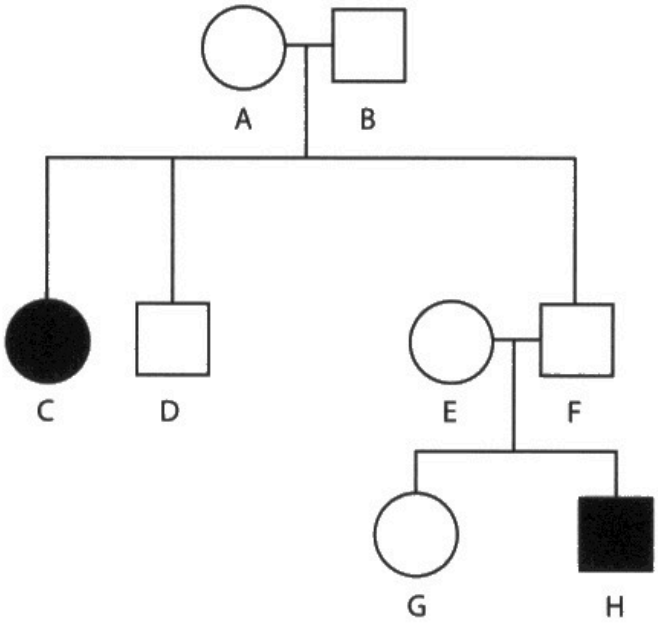
No credit for this response.

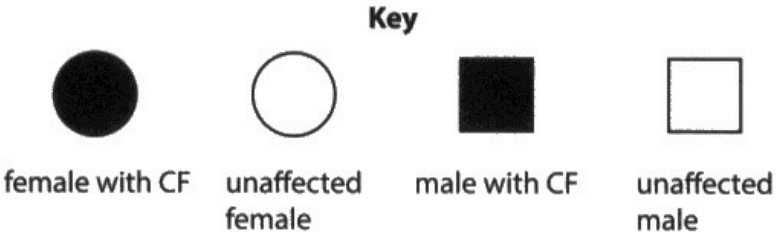
Question 8 (b)(i)

This item gave a diagram showing a family pedigree with some people in the family having CF. Candidates were asked to use the pedigree to determine the genotypes of individuals A, B and C. Most responses were able to correctly give the genotypes.

(b) The diagram below shows a family pedigree.

Some people in the family have CF.





(i) Use the pedigree to determine the genotypes of individuals A, B and C.

(3)

A Aa

B Aa

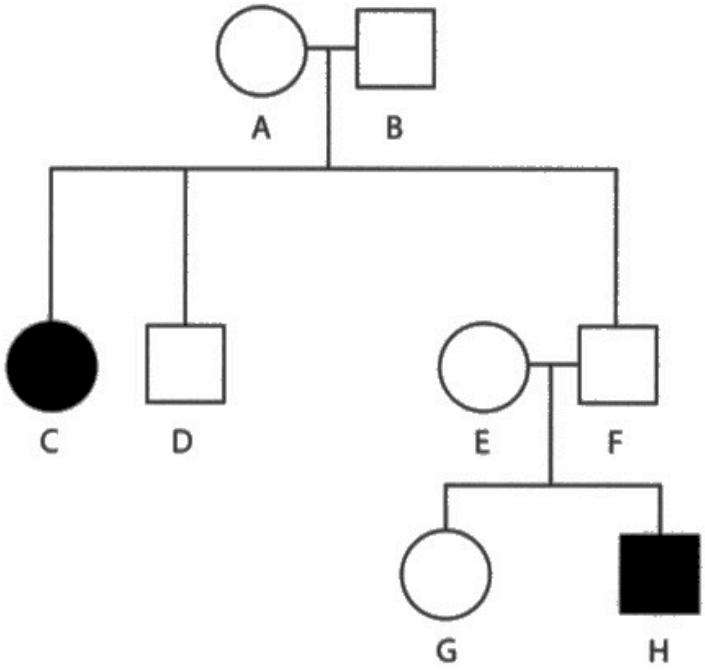
C [redacted] aa

ResultsPlus
Examiner Comments

This gains full marks.

(b) The diagram below shows a family pedigree.

Some people in the family have CF.



Key

female with CF | unaffected female | male with CF | unaffected male

(i) Use the pedigree to determine the genotypes of individuals A, B and C.

(3)

A Ff or FF

B Ff or FF

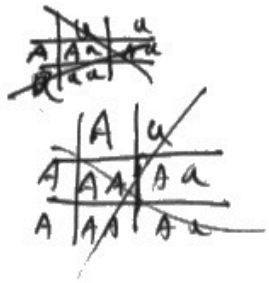
C ff

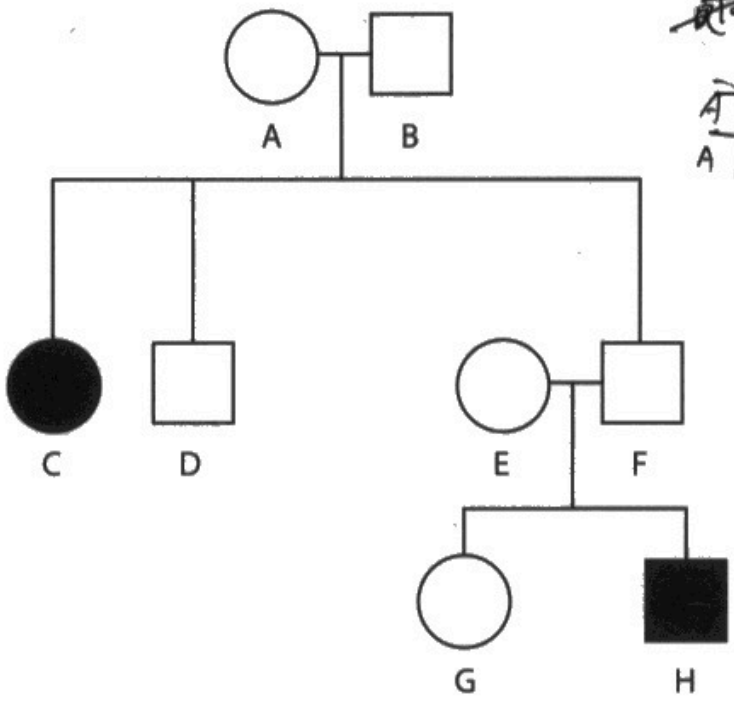
ResultsPlus
Examiner Comments

This gains one mark as incorrect alternatives are given for A and B.

(b) The diagram below shows a family pedigree.

Some people in the family have CF.





Key

female with CF | unaffected female | male with CF | unaffected male

(i) Use the pedigree to determine the genotypes of individuals A, B and C.

(3)

A Leterozygous - Nn

B ~~heterozygous~~ ~~homozygous~~ heterozygous - Nn

C homozygous recessive nn

ResultsPlus
Examiner Comments

This response also gains full marks.

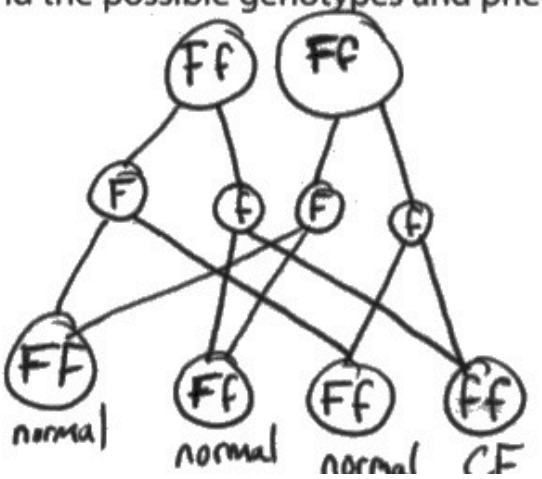
Question 8 (b)(ii)

In this item candidates were asked to draw a genetic diagram to show the genotypes of E and F, the gametes they produce and the possible genotypes and phenotypes of the offspring. Most candidates gained full marks, often using a Punnett square. Some responses did not gain full credit as they did not include the phenotypes of the offspring.

(ii) Individuals E and F have a third child.

Draw a genetic diagram to show the genotypes of E and F, the gametes they produce and the possible genotypes and phenotypes of the offspring.

(3)



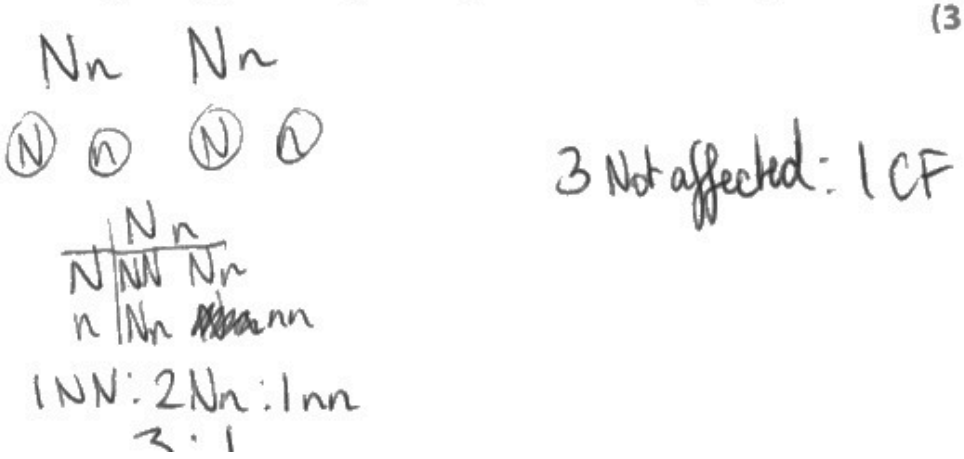
ResultsPlus
Examiner Comments

This response gains full marks for parent genotypes, gametes and offspring genotypes and phenotypes.

(ii) Individuals E and F have a third child.

Draw a genetic diagram to show the genotypes of E and F, the gametes they produce and the possible genotypes and phenotypes of the offspring.

(3)



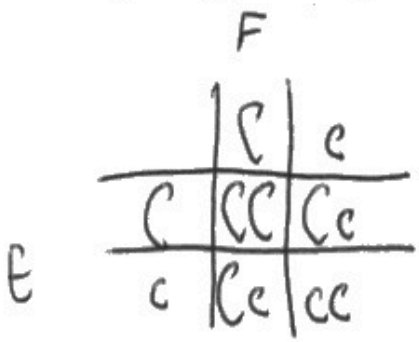
ResultsPlus
Examiner Comments

This response gains full marks for parent genotypes, gametes and offspring genotypes and phenotypes.

(ii) Individuals E and F have a third child.

Draw a genetic diagram to show the genotypes of E and F, the gametes they produce and the possible genotypes and phenotypes of the offspring.

(3)



ResultsPlus
Examiner Comments

This response gains two marks for parent genotypes and gametes but no third mark as offspring phenotypes not shown.

Question 8 (c)(i)

In this item candidates were told that the mucus that is produced in the pancreas is much thicker and blocks the pancreatic duct. They were asked to explain the effects this would have on human digestion. This item discriminated well between candidates with only the best responses gaining full marks. The best responses explained that the enzymes produced in the pancreas would not reach the small intestine. So amylase would not digest starch to maltose, lipase would not digest lipid to fatty acids and glycerol, and protease would not digest protein to amino acids. This would mean that these small molecules would not be absorbed.

(c) The gene for cystic fibrosis affects many different body systems including the digestive system and the reproductive system.

(i) The mucus that is produced in the pancreas is much thicker and blocks the pancreatic duct.

Explain the effects this would have on human digestion.

(3)

Stops enzymes entering the duodenum of the small intestine, eg amylase, proteases and lipases. This stops food being easily digested. No amylase means starch can't be broken down into amylase. No proteases means proteins can't be broken down into amino acids. No lipase means that emulsified fats can't be broken down into fatty acids and glycerol. No these enzymes affects digestion as it can't break food down. can't be easily absorbed either as they aren't broken down enough.

ResultsPlus
Examiner Comments

This response gains full marks. It gives the enzymes that cannot be released from the pancreas. It also writes that protein cannot be broken down into amino acids, that lipid cannot be broken down into fatty acids and glycerol. It also notes that these, therefore, cannot be absorbed.

(c) The gene for cystic fibrosis affects many different body systems including the digestive system and the reproductive system.

(i) The mucus that is produced in the pancreas is much thicker and blocks the pancreatic duct.

Explain the effects this would have on human digestion.

(3)

This would block the secretion of digestive enzymes such as amylase and protease into the duodenum in the small intestine. Starch would not be broken down into glucose, so could not be absorbed into the blood. The same would apply to proteins / polypeptide chains, which would not be broken down into amino acids.

ResultsPlus
Examiner Comments

This also gains full marks. It mentions the enzymes that will not be released. It states that protein cannot be broken down into amino acids. It also states that glucose cannot be absorbed.

(c) The gene for cystic fibrosis affects many different body systems including the digestive system and the reproductive system.

(i) The mucus that is produced in the pancreas is much thicker and blocks the pancreatic duct.

Explain the effects this would have on human digestion.

(3)

Pancreas would secrete fewer enzymes ~~so~~ like amylase to break down starch, so ~~dig~~ digestion will occur slower.

Perhaps more faeces.

ResultsPlus
Examiner Comments

This scores two marks. It mentions that amylase won't be secreted and that fewer enzymes would lead to less digestion. This scores marking point 1 and the additional guidance as alternatives to marking points 2, 3 and 4.

Question 8 (c)(ii)

In Q08(c)(ii) candidates were told that cystic fibrosis can result in the production of thick mucus which builds up in the cervix. They were asked to explain the effect this will have on reproduction. Candidates did slightly better on this item with almost all gaining credit for less fertilisation. The best candidates also noted that the sperm would not be able to reach the oviduct. Some responses wrote about mucus preventing the baby being delivered.

(ii) Cystic fibrosis can result in the production of thick mucus which builds up in the cervix.

Explain the effect this will have on reproduction.

(2)

As the thick mucus would build up in the cervix, it would prevent the deposition of sperm and would not allow the sperm to enter the fallopian tube to meet an egg for fertilisation so hence reproduction would be extremely unlikely as the thick mucus would block the sperm from entering the vagina and fallopian tube.

ResultsPlus
Examiner Comments

This response gains both marks.

(ii) Cystic fibrosis can result in the production of thick mucus which builds up in the cervix.

Explain the effect this will have on reproduction.

(2)

This will make fertilisation far less likely as the sperm ejaculated by the man then becomes less likely to fertilise the egg as it is more likely to be trapped by the thick mucus in the cervix. Therefore, less sperm will make it into the women and it is less likely for sperm to reach and fertilise the egg, making getting pregnant less likely

ResultsPlus
Examiner Comments

This gains two marks for making pregnancy less likely due to less chance of fertilisation.

Question 9 (a)(i)

In question 9 candidates were told that some students investigate the effect of mineral ions on plant growth. In Q09(a)(i) they had to state two variables the students kept constant in their experiment. Most responses could identify at least one variable with the best stating two variables. Suitable examples included: sunlight, volume of solution, number of leaves, species of plant and time in jar.

9 Students investigate the effect of mineral ions on plant growth.

They use four solutions A, B, C and D.

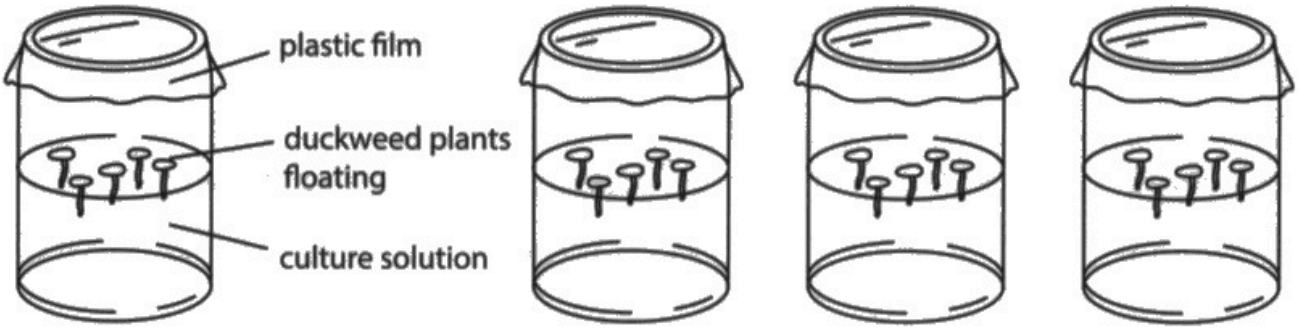
- A is a complete mineral solution that contains all of the mineral ions that a plant needs to grow normally
- B is a complete mineral solution without nitrate ions
- C is a complete mineral solution without magnesium ions
- D is a complete mineral solution without iron ions

The plant they use is duckweed, which grows on the surface of water.

Duckweed plant with one leaf

This is the students' method.

- place each of the four solutions (A, B, C and D) into separate jars
- float five plants of duckweed in each jar
- use plants with the same number of leaves, are the same size and are healthy
- cover each jar with plastic film



- put the jars containing the plants in sunlight
- after four weeks count the total number of leaves in each jar
- make a note of the size and colour of the leaves in each jar

(a) (i) State two variables the students kept constant in their experiment.

(2)

1 ~~temperature of surroundings~~ light intensity, duration of experiment

2 number of leaves ~~number~~, size, health of plants

ResultsPlus
Examiner Comments

This response gains two marks. Light intensity and duration of experiment. Number of leaves and size and health of plant would also be acceptable as a control variable.

9 Students investigate the effect of mineral ions on plant growth.

They use four solutions A, B, C and D.

- A is a complete mineral solution that contains all of the mineral ions that a plant needs to grow normally
- B is a complete mineral solution without nitrate ions
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Duckweed plant with one leaf

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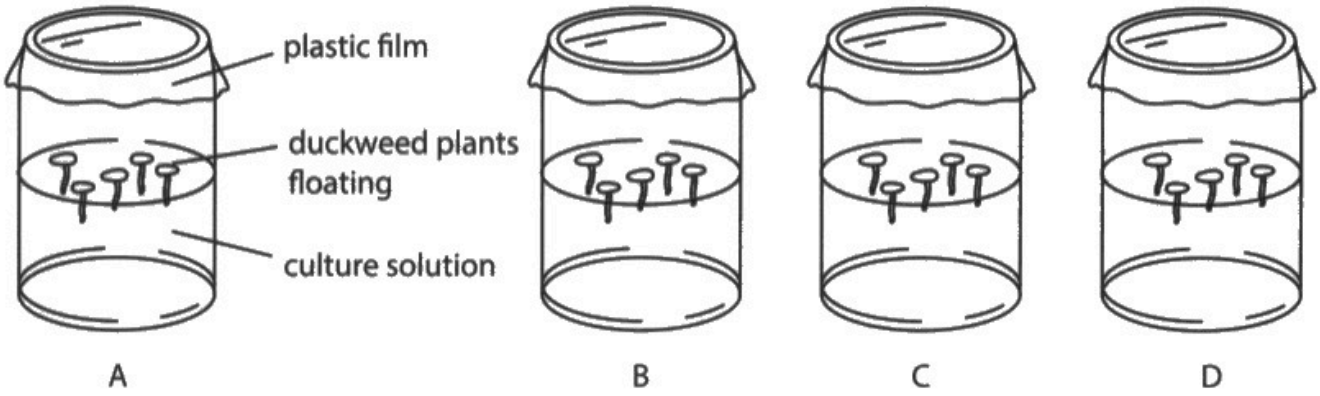


- put the jars containing the plants in sunlight
- after four weeks count the total number of leaves in each jar
- make a note of the size and colour of the leaves in each jar

(a) (i) State two variables the students kept constant in their experiment.

(2)

1 light intensity

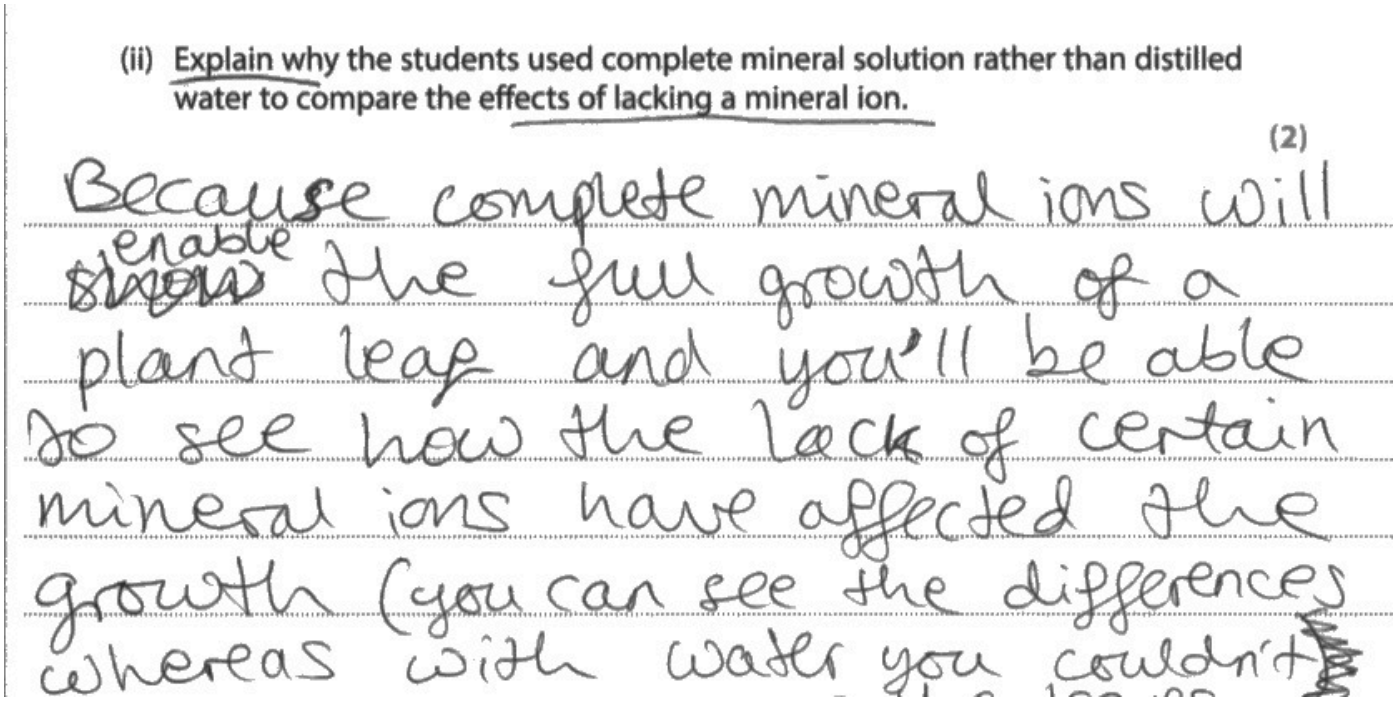
2 amount of duckweed in each jar

ResultsPlus
Examiner Comments

This also gains two marks, amount of duckweed allowed as number of plants and light intensity also credited.

Question 9 (a)(ii)

In Q09(a)(ii) candidates were asked to explain why the students used complete mineral solution rather than distilled water to compare the effects of lacking a mineral ion. Most responses gained at least one mark with the best responses explaining that plants would fail to grow well in distilled water but would show normal growth in a complete medium, allowing the effect of each mineral to be identified.



(ii) Explain why the students used complete mineral solution rather than distilled water to compare the effects of lacking a mineral ion.

(2)

Because complete mineral ions will ~~shows~~ enable the full growth of a plant leaf and you'll be able to see how the lack of certain mineral ions have affected the growth (you can see the differences whereas with water you couldn't

ResultsPlus
Examiner Comments

This response gains both marks for noting that complete mineral solution would show full growth – allowing the effect of lacking a certain mineral ion to be determined.

(ii) Explain why the students used complete mineral solution rather than distilled water to compare the effects of lacking a mineral ion.

(2)

~~to ensure that~~ because distilled water does not contain all the nutrients needed for plants growth and the ~~leaf~~ leaves in distilled water will have an abnormal appearance and growth (e.g with yellow leaves and stunted growth)

ResultsPlus
Examiner Comments

This gains one mark for explaining that the plants will not grow well in distilled water.

Question 9 (a)(iii)

In Q09(a)(iii) candidates had to explain why the jars are kept in sunlight. Most responses could state that sunlight is required for photosynthesis so that the plants can produce glucose for growth.

(iii) Explain why the jars are kept in sunlight.

(2)

o Light is needed for photosynthesis. If they do not produce glucose for respiration and organic matter, no growth will occur even if all the correct ions are present.

ResultsPlus
Examiner Comments

This gains full marks for reference to photosynthesis producing glucose for growth.

(iii) Explain why the jars are kept in sunlight.

(2)

So that the Duckweed can photosynthesise and provide glucose (energy) to grow leaves

ResultsPlus
Examiner Comments

This answer also gains both marks.

(iii) Explain why the jars are kept in sunlight.

(2)

So that the Pondweed can do photosynthesis and continue living

ResultsPlus
Examiner Comments

This response gains one mark for photosynthesis.

Question 9 (a)(iv)

In Q09(a)(iv) most responses could give the independent variable in this investigation.

(iv) State the independent variable in this investigation.

(1)

[redacted] solution ~~but~~ without certain mineral ions

which mineral ion is missing

ResultsPlus Examiner Comments

This gains the mark.

(iv) State the independent variable in this investigation.

(1)

total number

the ~~mass~~ of duckweed

ResultsPlus Examiner Comments

No credit as this is not the independent variable.

(iv) State the independent variable in this investigation.

(1)

the contents of the mineral solution.

ResultsPlus Examiner Comments

This gains the mark.

(iv) State the independent variable in this investigation.

(1)

The lack of a certain type of mineral ions in the culture solution.

ResultsPlus
Examiner Comments

This gains the mark.

(iv) State the independent variable in this investigation.

(1)

Sunlight.

ResultsPlus
Examiner Comments

No credit for sunlight.

Question 9 (b)(i)

In question 9(b) the candidates were told that the students record the total number of leaves in each jar.

They classify the leaf size as large, medium and small. They record leaf colour as how green the leaves were between 0 for white to 5 for dark green.

The candidates were given a table of the students' results.

In Q09(b)(i) about half of the candidates were able to give the difference between quantitative and qualitative results.

(b) The students record the total number of leaves in each jar.

They classify the leaf size as large, medium and small.

They record leaf colour as how green the leaves were between 0 for white to 5 for dark green.

The students' results are shown in the table.

Solution	Mineral lacking	Total number of leaves	Leaf size	Leaf colour
A	none	13	large	4
B	nitrate	7	small	2
C	magnesium	8	medium	2
D	iron	9	medium	1

(i) Some of the observations such as number of leaves are quantitative and some such as leaf size are qualitative.

Give the difference between quantitative and qualitative results.

(1)

quanhitative data is numbers and qualitative is words

ResultsPlus
Examiner Comments

This response gains the mark.

(b) The students record the total number of leaves in each jar.

They classify the leaf size as large, medium and small.

They record leaf colour as how green the leaves were between 0 for white to 5 for dark green.

The students' results are shown in the table.

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A	none	13	large	4
B	nitrate	7	small	2
C	magnesium	8	medium	2
D	iron	9	medium	1

(i) Some of the observations such as number of leaves are quantitative and some such as leaf size are qualitative.

Give the difference between quantitative and qualitative results.

(1)

quantitative data is numbers and statistics.

qualitative is judgements and opinions.

ResultsPlus
Examiner Comments

This response gains the mark.

(b) The students record the total number of leaves in each jar.

They classify the leaf size as large, medium and small.

They record leaf colour as how green the leaves were between 0 for white to 5 for dark green.

The students' results are shown in the table.

Solution	Mineral lacking	Total number of leaves	Leaf size	Leaf colour
A	none	13	large	4
B	nitrate	7	small	2
C	magnesium	8	medium	2
D	iron	9	medium	1

(i) Some of the observations such as number of leaves are quantitative and some such as leaf size are qualitative.

Give the difference between quantitative and qualitative results.

(1)

- Quantative results have a specific number (specific value)
- Qualitative results are based on a quality. They are subjective and dependent on observation.

ResultsPlus
Examiner Comments

This response also gains the mark.

Question 9 (b)(ii)

In the final evaluative item of this paper candidates were asked to comment on the students' results. They were told that in their answer they should use data from the table and their own knowledge. This item produced a wide range of scores. Many responses scored full marks. Candidates who failed to gain credit merely repeated data from the table without any comparison between the solution lacking the ion and the control.

(ii) Comment on the students' results.

In your answer you should use data from the table and your own knowledge.

(6)

The students results show that all three ions removed are necessary for optimal growth, as solution A has the greatest total of leaves, largest leaves, and greenest leaves. These are all signs of healthy leaves. The solution without nitrates is shown to have reduced size and number of the leaves the most, this is because nitrates helps produce proteins and amino acids which help the leaves grow and repare themselves. The solution without magnesium has a reduced leaf colour to almost white as magnesium produces chlorophyll, and so without it less photosynthesis occurs. It is the chlorophyll which gives the leaves their green colour so without it they are almost white. A lack of iron also reduces the green colour to white, as iron is required to transport oxygen. Without oxygen the leaves can't respire as much.

ResultsPlus
Examiner Comments

This scores full marks. It comments on the complete solution having the most and greenest leaves. It also notes that without nitrate has fewer leaves and is less green. It notes that nitrate is required to make protein. It notes that without magnesium the leaves are all almost white and that magnesium is required to produce chlorophyll.

(ii) Comment on the students' results.

In your answer you should use data from the table and your own knowledge.

(6)

• When testing nitrates the ~~test tube~~ ~~water~~ was not ~~as~~ ~~green~~ as when it had all the minerals. This is ~~because~~ nitrates

: When testing nitrates the amount of leaves was lower than when ~~the~~ nitrates were present. This is because nitrates ~~produce~~ ~~protein~~ help the plant make ~~pro~~ proteins. ~~in~~ Proteins help the plant grow and this is shown by the lack of leaves when nitrates weren't present.

• The plant also had a decrease in green colour ~~as~~ as less chlorophyll is made as a result in the lack of nitrates. This is ~~as~~ the same for the other minerals but Iron the colour becomes even lesser of a green. This is because iron is ~~responsible for~~ mainly responsible for the production of the pigment in chlorophyll ~~that~~ that make the plant green.

• both magnesium and iron also help with plant growth. This is clear to see in the table ~~as~~ as when they ~~were~~ ~~were~~ removed the amount of leaves decreased

(Total for Question 9 = 14 marks)

ResultsPlus
Examiner Comments

This scores five marks. It notes that without nitrate has fewer leaves as nitrate is required for protein. It notes that in solution without iron the leaves are less green. Iron is required for chlorophyll. Finally it notes that in solution without magnesium there are fewer leaves.

Question 10

Candidates were asked to design an investigation to find the carbon dioxide concentration needed for maximum crop yield. This item produced the whole range of scores with many candidates scoring 5 or 6 marks. This item differed slightly from previous CORMS items as candidates were asked to find the concentration that produces most yield. Therefore the examiners expected candidates to use a range of carbon dioxide concentrations rather than carbon dioxide and no carbon dioxide. Most candidates were able to do this. Some responses did not specify how they would measure yield or used height of a crop as their measure.

10 Carbon dioxide can be added to a glasshouse to increase the yield of a crop plant.

Design an investigation to find the carbon dioxide concentration needed for maximum crop yield.

Include experimental details in your answer and write in full sentences.

C✓ O✓ R✓ M✓ M✓ S✓ S✓ (6)

- Get ~~two~~ three glass houses, varying the CO_2 concentration ~~one with CO_2 and one without CO_2~~*. Use a paraffin heater for the glass houses with CO_2 to vary it. seeds
- In ~~both~~ all the glass houses put plants of the all same species, age and make sure to for ~~both~~ all glass houses ~~both~~ they ~~both~~ have the same temperature, light intensity and oxygen levels (for respiration) and water
- after 4 ~~wea~~ weeks ~~with equal watering~~ measure the number of plants by counting the number of ~~green leaves~~ plants
- repeat and find mean average
- whichever ~~to~~ glass house contained more plants after the 4 weeks suggests which CO_2 concentration is needed for maximum crop yield.

* The first glass house with low CO_2 concentration, the second with moderate CO_2 concentration, the third with high CO_2 concentration

ResultsPlus
Examiner Comments

This response scores full marks. It gains C for three different concentrations of carbon dioxide. It gains O for the same species of plant. It also gains S1 for light and S2 for water being controlled. It gains M2 for reference to after 4 weeks and R for repeating the experiment.

10 Carbon dioxide can be added to a glasshouse to increase the yield of a crop plant.

Design an investigation to find the carbon dioxide concentration needed for maximum crop yield.

Include experimental details in your answer and write in full sentences.

(6)

C ✓
O ✓
R ✓
M ✓
M ✓
S ✓
S ✓

add a range of concentrations of carbon dioxide to 5 glasshouses. Keep the same species of crop plant in each glasshouse, for example strawberries. count how many crops have grown before, and count again every 24 hours for a week. repeat this 3 times for each concentration of carbon dioxide. Keep the temperature and size of each glasshouse the same.

ResultsPlus
Examiner Comments

This response also scores full marks for C, O, M1 , M2, R and S1. M1 was allowed for how many strawberries were produced.

10 Carbon dioxide can be added to a glasshouse to increase the yield of a crop plant.

Design an investigation to find the carbon dioxide concentration needed for maximum crop yield.

Include experimental details in your answer and write in full sentences.

C ✓
O ✓
R ✓
M ✓
M ✓
S ✓
S ✓
(6)

The concentration of carbon dioxide can be changed in glasshouses containing crop plants of the same species and size. The investigation could include three glasshouses for each concentration of carbon dioxide. Glasshouses 1, 2 and 3 could contain 50% concentration of CO_2, glasshouses 4, 5 and 6 could contain 75% concentration of CO_2 and glasshouses 7, 8, and 9 could contain 100% concentration of CO_2. This will improve accuracy. The amount of crop yield produced could be measured after 7 days in each glasshouse. The size of the glasshouses must stay the same and the temperature of the glass houses ~~must~~ must also stay the same.

ResultsPlus
Examiner Comments

This response scores five marks. It gains C, R, O, M2 and S1. It doesn't state how yield should be measured.

Paper Summary

Based on their performance on this paper, candidates should:

- Ensure that you read the question carefully and include sufficient points to gain full credit. Include as many points as there are marks available in 'discuss' and 'comment' items.
- Make sure you have practised calculations, given in the appendix of the specification, and that you understand and know how to apply formulae and always include all your working.
- Write in detail and use correct and precise biological terminology.
- Revise practical work to help in questions about unfamiliar or novel practical procedures.
- Note that sometimes questions require candidates to make links between different parts of the specification, so when considering a question remember to use all the knowledge and understanding you have gained throughout the specification.
- Make sure you know and understand all of the terms in the specification.
- Always be able to identify the variables in experiments.
- Ensure in experiment design questions to give the independent variable and the range you are going to use, the dependent variable, how you are going to measure it and the control variables and explain how these will be controlled.
- Always read through your responses and ensure that what you have written makes sense and answers the question fully.