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Examiners' Report
June 2023

Int GCSE Biology 4BI1 1BR

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Introduction

The examiners were extremely impressed with the excellent standard of many of the scripts seen. Most candidates demonstrated an excellent knowledge of the topics covered in the assessment and impressive practical and mathematical skills. Both candidates and centres should be commended for the excellent preparation that they had clearly undertaken prior to this examination series. The level of factual detail presented by most candidates was of an excellent standard and it was pleasing to see the confidence with which candidates use key scientific vocabulary. Most candidates showed strong analytical skills and tackled the longer discussion / evaluation style questions well. Answers to practical questions were generally very good and most candidates have a strong understanding of the scientific method and understand the need for controlling variables and repeating experiments to ensure validity. A few candidates were unclear as to the distinction between practical terms such as accurate, precise and reliable – it is good practice to use these terms when undertaking routine practical work so that candidates are fully familiar with them. The practical planning, CORMS-style question was very well answered, and it was obvious to the examiners that centres and candidates worked hard on practical planning skills. Mathematical skills were generally very strong with most candidates being able to carry out the required numerical methods.

Similarly, graph plotting was excellent, and most candidates were able to select sensible linear scales and produce graphs that were fully labelled and plotted accurately. Where some candidates lost marks and found questions challenging, it was typically due to not giving sufficient detail, such as not referring to lactose or lactic acid during yoghurt production, misinterpreting command words (describe and explain are often confused) and not referring to all the patterns shown by data on longer answer questions. When answering longer answer, data analysis style questions, candidates should explore all patterns thoroughly, suggest explanations and also discuss reasons why the data or conclusions may not be valid (this can include aspects of data that do not fit a trend or experimental design). Candidates should also try to manipulate the data rather than just quoting data. Candidates should also make sure that they are fully familiar with the demands of all the command words and the required mathematical skills – these can all be found in the specification.

Question 1 (a)(iii)

This question required candidates to use their knowledge of the function of cell walls and osmosis to explain why bacteria do not burst when placed into water, but red blood cells do. Many excellent answers were seen that explained the role of the cell wall and also explained that osmosis would occur, causing water to flow into cells from a higher to a lower water potential. When referring to the movement of water by osmosis, candidates should refer to water potentials or the concentrations of solution, for example, the movement of water from a more dilute solution into a more concentrated salt solution. Some candidates found the question challenging and incorrectly suggested that cell membranes would prevent cells bursting or that the cell wall would prevent water crossing it.

(iii) *Lactobacillus* cells do not burst when placed in distilled water.

Red blood cells burst when placed in distilled water.

Explain why the *Lactobacillus* cells do not burst but the red blood cells do burst.

(3)

Water enters the cells through osmosis down a water potential gradient. Lactobacillus cells have a cell wall so when water enters from high water potential to low water potential through a ~~semi~~ permeable membrane the lactobacillus cells become turgid (the cell wall protects it). Meanwhile, Red blood cells have no cell wall so when water enters it, it bursts.

ResultsPlus
Examiner Comments

This excellent answer gained three marks. The candidate has clearly stated that water enters the cells via osmosis, given a correct definition of osmosis and explained the role of the cell wall.

ResultsPlus
Examiner Tip

If you refer to osmosis, always define it in your answer.

(iii) *Lactobacillus* cells do not burst when placed in distilled water.

Red blood cells burst when placed in distilled water.

Explain why the *Lactobacillus* cells do not burst but the red blood cells do burst.

(3)

Lactobacillus cells have cell walls which help them hold their shape even when water moves into the cell through osmosis so they will not burst. rad blood cells dont have cell walls.

ResultsPlus
Examiner Comments

This answer also gained three marks for correctly referring to cell walls, water entry and the movement of water by osmosis.

(iii) *Lactobacillus* cells do not burst when placed in distilled water.

Red blood cells burst when placed in distilled water.

Explain why the *Lactobacillus* cells do not burst but the red blood cells do burst.

(3)

- lactobacillus bacteria is used in sterilized process (adapted)
- red blood cell is not adapted to distilled water.
- red blood cell does not contain cell wall
- ~~dis~~ Lactobacillus contains cell wall and cell membrane for protection.

ResultsPlus
Examiner Comments

This answer gained one mark for recognising that the cell wall was responsible. No further explanation was given.

Question 1 (b)

This question asked candidates to describe the role of Lactobacillus in the production of yoghurt. Some excellent answers were seen that explained how respiration occurs, converting lactose sugar into lactic acid. Some candidates found the question challenging and did not refer to lactose sugar or lactic acid, giving vague answers about the role of bacteria in causing the yoghurt to thicken. Only the strongest answers referred to the coagulation of proteins as pH falls. Some candidates confused increasing acidity with increasing pH, suggesting that the milk becomes more alkaline. Some candidates referred to how humans commercially produce yoghurt, rather than the role of the bacteria, and described the process of sterilisation, addition of the yoghurt and cooling after it had been made.

(b) Describe how *Lactobacillus* bacteria produce yoghurt from milk.

(3)

Milk is first sterlised to kill unwanted micro-organisms, then it is pasturised, afterwards it is cooled and ~~Lacto bac~~ Lactobacillus is added. Milk is incubated at 40°C and placed into a fermenter, the micro-organisms/bacteria break down lactase into lactic acid. Flavours are added to the yoghurt

ResultsPlus
Examiner Comments

This answer gained one mark for correctly stating that lactic acid is produced. The candidate has unfortunately written lactase rather than lactose – phonetic spelling is generally accepted unless the word can be mistaken for a different term.

ResultsPlus
Examiner Tip

Be careful with spelling as if the way a word is spelt could make it sound like a different term, then the mark will not be given. For example lactase is the name of an enzyme, lactose is a sugar.

(b) Describe how *Lactobacillus* bacteria produce yoghurt from milk.

(3)

~~lacto~~, The milk is pastuerised for 15 - 20 mins and lactobacillus produces lactic acid which is a starter culture that is stirred ~~and~~ at the optimum temperature ~~to work~~ for the bacteria to work and the is cooled at 5°c to not kill the bacteria.

ResultsPlus
Examiner Comments

This answer gained one mark for the description of lactic acid production. No other marks were awarded – there is plenty of detail about how to produce yoghurt but it is not relevant to the question.

(b) Describe how *Lactobacillus* bacteria produce yoghurt from milk.

(3)

When Lactobacillus bacteria respires anaerobically, it produces lactic acid. ~~lactic acid~~ Milk is pasteurised and heated. Cooled down and respires anaerobically to form lactic acid. Lactic acid ~~me~~ makes milk become solidified to yoghurt and gives it its sour taste.

(Total for Question 1 = 8 marks)

ResultsPlus
Examiner Comments

This answer gained all three marks for correctly referring to lactic acid, respiration and the solidification of the yoghurt.

(b) Describe how *Lactobacillus* bacteria produce yoghurt from milk.

(3)

After milk is heated ~~at 35°C for~~ and cooled down, lactobacillus is inoculated into the milk and left to sit for 3-12 hours. The lactobacillus break down protein in the milk to form lactic acid, which causes the milk to thicken and become yoghurt.

ResultsPlus
Examiner Comments

This answer gained two marks for the production of lactic acid and the thickening of the yoghurt due to the acidity.

Question 2 (a)

This question asked for a simple description of how food is moved from the mouth to the stomach. Most candidates were able to correctly name the oesophagus, although a few candidates confused it with the trachea. Many candidates also correctly referred to peristalsis. Fewer candidates described the process of peristalsis as waves of muscular contraction. A few candidates gave vague answers that referred to muscles but not contraction.

2 The photograph shows some seeds called lentils.

© Diana Taliun/Shutterstock

Lentils are a good source of protein and are often eaten as part of a balanced diet.

(a) Describe how lentils are transported from the mouth to the stomach after being eaten.

(2)

Through the rythmatic relaxation and the contration of the circular and logitutional muscles in a process known as peristalsis.

ResultsPlus
Examiner Comments

This excellent answer gained both marks for naming the process of peristalsis and describing it as waves of muscular contractions.

ResultsPlus
Examiner Tip

Always use key terms where appropriate, such as oesophagus and peristalsis, in your answers.

2 The photograph shows some seeds called lentils.

Lentils are a good source of protein and are often eaten as part of a balanced diet.

(a) Describe how lentils are transported from the mouth to the stomach after being eaten.

(2)

The lentils are transported from the mouth through oesophagus with a perilstasis and is the transported to the stomach

ResultsPlus
Examiner Comments

This answer gained two marks for naming the oesophagus and the process of peristalsis.

2 The photograph shows some seeds called lentils.

© Diana Taliun/Shutterstock

Lentils are a good source of protein and are often eaten as part of a balanced diet.

(a) Describe how lentils are transported from the mouth to the stomach after being eaten.

(2)

Lentils are mechanically broken down by the teeth in the mouth. Then it travels down to the Oesophagus via peristalsis which uses waves of circular muscle contractions to push bolues down into the stomach.

ResultsPlus
Examiner Comments

This excellent answer gained all three marks for naming the oesophagus, the process of peristalsis and describing peristalsis correctly.

Question 2 (b)(i)

In this question, candidates had to look at a table of substances found in lentils and identify one component of a balanced diet that was not included. The two missing components were fibre and water, although alternative vitamins and minerals (calcium and vitamin C were given in the table) were also accepted. Many candidates gave a correct substance and gained the mark. Some candidates incorrectly referred to a substance in the table or other types of carbohydrate or fat.

(i) Give one component of a balanced diet that is not shown in the table.

(1)

Iron

ResultsPlus
Examiner Comments

This answer gained one mark for giving a different mineral – iron.

(i) Give one component of a balanced diet that is not shown in the table.

(1)

Glucose

ResultsPlus
Examiner Comments

This answer gained no marks as carbohydrates were included in the table.

(i) Give one component of a balanced diet that is not shown in the table.

(1)

• fibre

ResultsPlus
Examiner Comments

This answer gained one mark for correctly stating fibre.

Question 2 (b)(ii)

This question required candidates to give the long-term effects of a shortage of vitamin C and calcium. Many excellent answers were seen that correctly described scurvy (or its symptoms) and rickets / brittle bones or other correct skeletal problems. A few candidates confused vitamin C with vitamin A and suggested night blindness.

(ii) Lentils do not contain large amounts of vitamin C and calcium.

State the long-term effect of a dietary shortage of vitamin C and of calcium.

(2)

vitamin C

A vitamin C deficiency can lead to scurvy, a disease that causes the irritability and bleeding of gums.

calcium

A deficiency in calcium leads to improper bone formation or support causing rickets.

ResultsPlus
Examiner Comments

This is a good answer that gained both marks for correctly stating scurvy (and the symptoms) and rickets.

(ii) Lentils do not contain large amounts of vitamin C and calcium.

State the long-term effect of a dietary shortage of vitamin C and of calcium.

(2)

vitamin C

deficiency causes rickets

calcium

bones and teeth wont be strong

ResultsPlus Examiner Comments

This answer gained one mark for a correct function of calcium. The candidate has confused the function of vitamin C with the function of vitamin D.

(ii) Lentils do not contain large amounts of vitamin C and calcium.

State the long-term effect of a dietary shortage of vitamin C and of calcium.

(2)

vitamin C

lack of vitamin c will lead to diseases such as scurvy

calcium

calcium is needed for stronger bones without it your body will become weak

ResultsPlus Examiner Comments

This answer gained two marks for correctly stating that a lack of vitamin C leads to rickets and a lack of calcium leads to weaker bones.

Question 2 (b)(iii)

This calculation required candidates to use the information in the table, that 50 g of lentils provides 22% of the RDA for protein, to calculate the total mass of lentils required. The question also asked for the answer to be given to two significant figures. Many candidates gained both marks and set out clear, well organised working. Some candidates gained one mark as they gave answers to two decimal places rather than two significant figures.

(iii) Calculate the mass, in grams, of lentils that a 16-year-old needs to eat, each day, to provide their RDA of protein.

Give your answer to two significant figures. (2)

50grams = 22%.

$\frac{50}{22} = 1\%$.

$\frac{50}{22} \times 100 = 227.279$

mass of lentils needed each day = 227.27 g

ResultsPlus
Examiner Comments

This answer gained one mark. The calculation is correct but the final answer is given to two decimal places rather than two significant figures.

ResultsPlus
Examiner Tip

Be clear what are meant by the terms significant figures and decimal places.

(iii) Calculate the mass, in grams, of lentils that a 16-year-old needs to eat, each day, to provide their RDA of protein.

Give your answer to two significant figures.

(2)

22% → 50g

1% = $\frac{50}{22}$ = 2.2727....

≈ 230

100% = 2.27... × 100 = 227.27...

mass of lentils needed each day = 230 g

ResultsPlus
Examiner Comments

This answer gained both marks. The answer is correct and given to two significant figures. The working is very clear – an example of good practice.

ResultsPlus
Examiner Tip

Always show your working clearly – it may gain marks even if the final answer if incorrect.

Question 2 (b)(iv)

This question asked for a simple description of how proteins are digested in the alimentary canal. Many excellent answers were seen that correctly identified the sites of digestion or enzyme production, the role of protease and stated that amino acids are the products of the digestion. Many answers correctly stated that pepsin is an example of a protease that is located in the stomach. Some candidates gave the wrong location for digestion (eg mouth), referred to absorption in the small intestine (rather than digestion), and / or named wrong enzymes such as amylase.

(iv) Describe how protein is digested in the human alimentary canal.

(3)

The protein is broken down from large insoluble molecules to small soluble ones called amino acids. The enzyme protease is used to break down proteins to amino acids. These amino acids are then absorbed into the blood from the small intestine.

ResultsPlus
Examiner Comments

This answer gained two marks for correct statements about protease and the production of amino acids. The candidate has stated that the small intestine is the site of absorption (which is correct but not asked for in the question) rather that referring to where digestion occurs.

(iv) Describe how protein is digested in the human alimentary canal.

(3)

Protein is broken up by the enzyme ~~pepsin~~ protase and is transformed into 'pepsin' in the small intestine. When it is broken down, it has a large surface area and is absorbed better in the blood.

ResultsPlus
Examiner Comments

One mark was awarded for the term protease. The candidate has referred to pepsin and the small intestine but the context is confused and so no credit was awarded for these.

(iv) Describe how protein is digested in the human alimentary canal.

(3)

~~Protein is divided by amylase to the maltose Then maltoses are divided by maltases to. protein~~ Protein is divided by pepsin in the stomache.

ResultsPlus
Examiner Comments

This answer gained two marks for a correct reference to pepsin in the stomach and a reference to the site of digestion as being in the stomach.

(iv) Describe how protein is digested in the human alimentary canal.

(3)

1. Protein is digested into ~~amino~~ peptide in the stomach by protease.
2. Stomach is acidic which can provide the optimum pH value for enzyme to work.
3. Then, peptide is digested into amino acid in the small intestine by pepsin.

ResultsPlus
Examiner Comments

This excellent answer gained three marks for the role of protease, the correct location and the products of digestion (amino acids).

Question 3 (a)(iii)

This question presented candidates with a woodland food web and asked candidates to explain why the transfer of energy was different through two different food chains. Many candidates gave excellent answers that explained that one food chain had an additional trophic level and so would lose more energy, often going on to list the ways in which the energy is lost, eg excretion, heat loss and undigested food. Weaker answers tended to give generic ways in which energy is lost without linking this to the lengths of the two food chains.

(iii) The fox receives 1% of the energy present in the oak tree.

The fox receives 0.04% of the energy present in the grass.

Explain why a higher proportion of the energy reaches the fox from the oak tree than reaches the fox from the grass.

(3)

In the food chains including the oak tree, the fox is a secondary consumer. In the food chains including grass, the fox is a tertiary and secondary consumer. As the number of consumers increase, energy decreases as energy is used for respiration, excretion and not all of the prey is consumed. ~~Thus, since~~ Since the fox is a secondary consumer of the oak tree and a tertiary consumer of grass, ~~the oak tree provides more~~ more energy from the oak tree is present for the fox to ~~recie~~ receive.

ResultsPlus
Examiner Comments

This excellent answer gained three marks. The candidate explains that the fox occupies different trophic levels in the two food chains and then goes on to give examples of ways in which the energy is lost.

(iii) The fox receives 1% of the energy present in the oak tree.

The fox receives 0.04% of the energy present in the grass.

Explain why a higher proportion of the energy reaches the fox from the oak tree than reaches the fox from the grass.

(3)

There is less trophic level. Energy could be lost due to ~~the~~ 1. Not all parts eaten (bone, ~~teeth~~ 2. Not digested / Absorbed 3. Excreted (Urea) 4. Decomposition / death 5. Respiration (heat loss, movement). Energy transfer is inefficient so ~~many~~ energy is lost during transfer process, the less trophic level the more energy fox receives. Fox is secondary consumer when energy reaches from oak tree, whereas Fox is tertiary consumer when reaches from grass

ResultsPlus
Examiner Comments

This answer gained three marks. The candidate gives two ways in which energy is lost and goes on to state that there are more levels in one chain than the other.

(iii) The fox receives 1% of the energy present in the oak tree.

The fox receives 0.04% of the energy present in the grass.

Explain why a higher proportion of the energy reaches the fox from the oak tree than reaches the fox from the grass.

(3)

Energy present in oak tree is more than grass because as organism eats other organisms energy stored decrease to 90% which means oak trees only pass on energy to rabbit then fox ~~but grass~~ which's only 1 organism but grass pass on energy to grasshopper then squirrel or mouse then finally to fox which show us that grass energy stored decrease more as it pass onto more organism while oak tree only pass onto rabbit.

ResultsPlus
Examiner Comments

This answer gained one mark for the idea of the two food chains having different numbers of trophic levels. No examples of the ways in which energy is lost are given.

(iii) The fox receives 1% of the energy present in the oak tree.

The fox receives 0.04% of the energy present in the grass.

Explain why a higher proportion of the energy reaches the fox from the oak tree than reaches the fox from the grass.

(3)

More trophic level feed on grass
Therefore energy loss during rabbit, squirrel, grasshopper and mouse eating the grass.
Energy can loss by respiration
Energy can loss by excretion

ResultsPlus
Examiner Comments

This answer gained three marks for stating that there are more trophic levels in one food chain and giving two methods by which energy is lost.

Question 3 (b)(i)

This question tested the candidates knowledge of practical work by asking why quadrats are placed at random. Most candidates appreciated that this would reduce bias or lead to a more valid or fair result. A number of candidates incorrectly suggested that it would improve reliability which refers to data being replicated.

(b) A student uses this method to estimate the total area of the woodland floor that is covered by grass.

- randomly place a 0.25 m^2 quadrat in one location of the woodland
- estimate the percentage of the quadrat that is covered by grass
- repeat at one other location
- calculate the mean percentage covered by grass for both quadrats
- measure the total area of the woodland floor
- calculate the total area of the woodland covered by grass.

(i) State why the student placed the quadrats randomly at each location.

(1)

This is to give unbiased results

ResultsPlus
Examiner Comments

This answer gained the mark for stating that the results would not be biased.

(b) A student uses this method to estimate the total area of the woodland floor that is covered by grass.

- randomly place a 0.25 m^2 quadrat in one location of the woodland
- estimate the percentage of the quadrat that is covered by grass
- repeat at one other location
- calculate the mean percentage covered by grass for both quadrats
- measure the total area of the woodland floor
- calculate the total area of the woodland covered by grass.

(i) State why the student placed the quadrats randomly at each location.

(1)

They did this to ensure the reliability of their method, and their samples weren't biased towards a particular corner of the

ResultsPlus
Examiner Comments

This answer gained one mark for the idea of bias. No credit was awarded for the idea of reliability but credit was not lost for making this statement.

Question 3 (b)(ii)

This question again assessed candidates' practical understanding and asked them to explain how they could improve the reliability of the results. Most candidates recognised that the quadrat could be placed more times, but only stronger candidates gave more detail such as the calculation of a mean, the detection of anomalies, or a method for gridding the area.

(ii) Explain how the student could improve their method, to obtain a more reliable estimate of the total area of woodland covered by grass.

(2)

calculate the percentage of the quadrat that is covered by grass instead of estimate. Repeat the investigation.

ResultsPlus
Examiner Comments

This answer gained one mark for the idea of repeats.

ResultsPlus
Examiner Tip

Make sure that you know the differences between the terms reliable, accurate, valid and precise.

(ii) Explain how the student could improve their method, to obtain a more reliable estimate of the total area of woodland covered by grass.

(2)

The student could improve their method by using similar measurements of the grass needed to cover the woodland floor to gain reliable data.

ResultsPlus
Examiner Comments

No marks were awarded for this answer. The answer gives vague statements without any explanation of how the reliability could be improved.

(ii) Explain how the student could improve their method, to obtain a more reliable estimate of the total area of woodland covered by grass.

(2)

3 or 4

He The student should place more qudrats at ~~other~~ more location ~~as~~ and calculate the mean percentage covered by grass

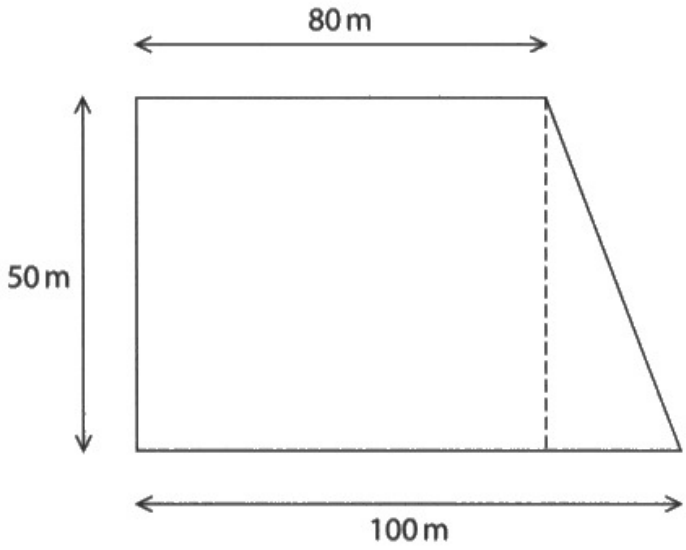
ResultsPlus
Examiner Comments

This answer gained two marks. The candidate states that the experiment will be repeated and goes on to state that means will be taken.

Question 3 (b)(iii)

This mathematical question was completed correctly by many candidates. Most candidates were able to calculate the area of the rectangle but fewer candidates correctly added the area of the triangle. Most candidates were also able to go on to calculate the correct percentage. Mathematical skills were very good on most of the questions on this paper.

(iii) The diagram shows the dimensions of the woodland.



The student finds the mean percentage of the two quadrats covered by grass is 65%.

Use this value to calculate the total area of the woodland floor covered by grass.

(3)

$(50 \cdot 80 + 20 \cdot 50 \cdot \frac{1}{2}) \cdot \frac{65}{100}$

$= (4000 + 500) \cdot 0.65$

$= 4500 \cdot 0.65$

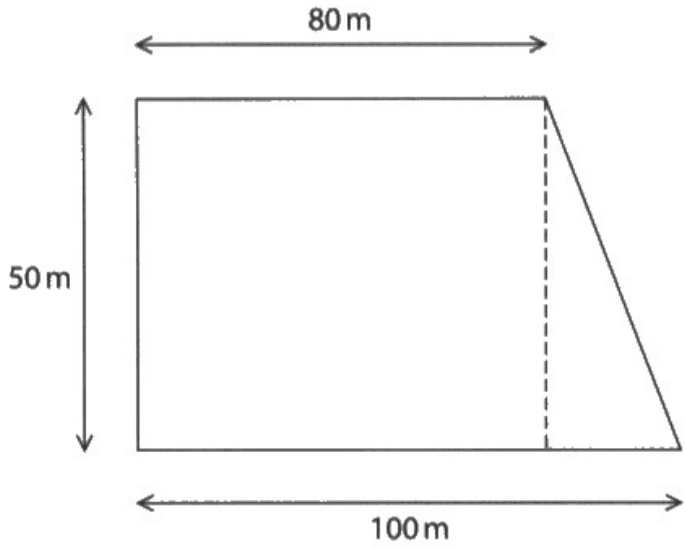
$= 2925$

total area covered by grass = 2925 m^2

ResultsPlus
Examiner Comments

This correct answer gained three marks. The candidate has shown their working clearly and the answer is an example of good practice.

(iii) The diagram shows the dimensions of the woodland.



The student finds the mean percentage of the two quadrats covered by grass is 65%.

Use this value to calculate the total area of the woodland floor covered by grass.

(3)

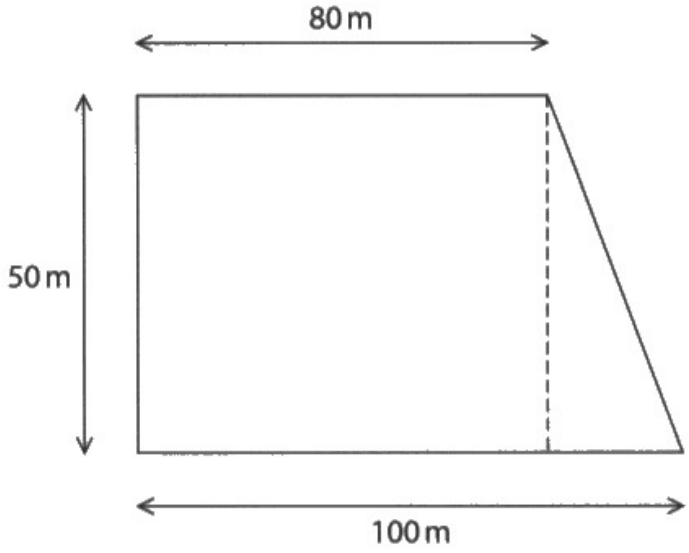
$\frac{(80+100)\times 50}{2} \times 65\% = 2925\ m^2$.

total area covered by grass = 2925. m^2

ResultsPlus
Examiner Comments

This is another answer that gained all three marks. The working is slightly different to the previous answer but nonetheless is correct.

(iii) The diagram shows the dimensions of the woodland.



The student finds the mean percentage of the two quadrats covered by grass is 65%.

Use this value to calculate the total area of the woodland floor covered by grass.

(3)

$\frac{(80+100)\times 50}{2}$

$80+100=180$

$180\times 50=9000$

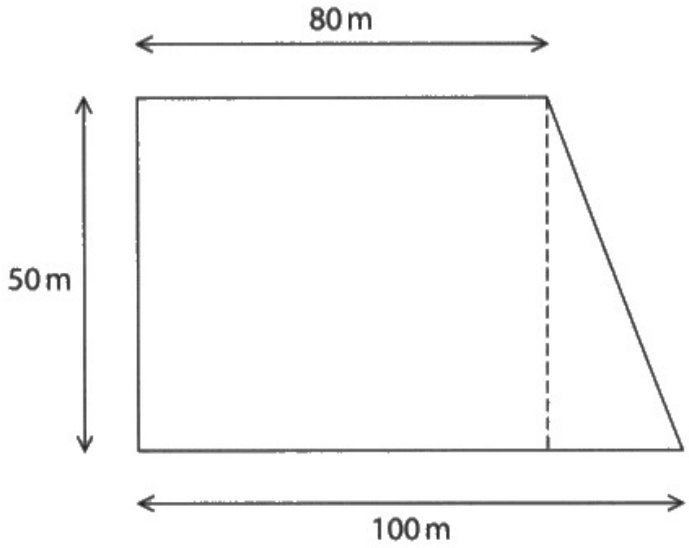
$9000\div 2=4500$

total area covered by grass = 4500 m^2

ResultsPlus
Examiner Comments

This answer gained two marks. The candidate has correctly calculated the total area but did not go on to calculate the percentage.

(iii) The diagram shows the dimensions of the woodland.



The student finds the mean percentage of the two quadrats covered by grass is 65%.

Use this value to calculate the total area of the woodland floor covered by grass.

50x80 = 4000

(3)

total area covered by grass = 4000 m^2

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Examiner Comments

This answer gained one mark. The candidate has only calculated the area of the rectangle within the shape.

Question 4 (b)(i)

This question tested candidates understanding of how to investigate how temperature affects the rate of anaerobic respiration of yeast. In this first part of the question, candidates were asked to state the purpose of the oil over the solution. Most recognised that the oil would prevent the entry of oxygen and so gained a mark. Some candidates gave a vague reference to preventing air getting in – candidates should be clear that it is preventing oxygen getting in.

(i) State the function of the paraffin oil.

(1)

« To prevent oxygen from entering so that the yeast cells only undergo anaerobic respiration.

ResultsPlus
Examiner Comments

This answer gained one mark for correctly stating that the oil prevents oxygen entry.

(i) State the function of the paraffin oil.

(1)

Since it is thick it will not dissolve into the glucose solution and perhaps not allow gas bubbles

ResultsPlus
Examiner Comments

This answer gained no mark as there is no reference to oxygen or the prevention of aerobic respiration.

Question 4 (b)(ii)

This question was again focused on practical work, asking candidates to describe how they could modify the apparatus to maintain the temperature. Many candidates found the question challenging and gave vague answers about checking the temperature without stating that a water bath could be used and monitored using a thermometer. Candidates should be clear to state how they will do things rather than giving vague statements.

(ii) Describe a method the student could use to keep the temperature of the yeast and glucose mixture constant.

(2)

they could stir the yeast and glucose mixture so the temperature is spread out evenly.

ResultsPlus
Examiner Comments

This answer gained no marks. The candidate has described how to maintain an even temperature rather than to maintain a constant temperature.

(ii) Describe a method the student could use to keep the temperature of the yeast and glucose mixture constant.

(2)

put the test tube in a water bath of ~~set~~ desired temperature and use thermometer to measure

ResultsPlus
Examiner Comments

This answer gained both marks for correctly stating that a water bath and thermometer would be used.

(ii) Describe a method the student could use to keep the temperature of the yeast and glucose mixture constant.

(2)

Keep the test tube containing yeast and glucose solution in a water bath (using a beaker) at ~~27°C~~ 25°C or 37°C.

ResultsPlus
Examiner Comments

This answer gained one mark for the use of a water bath but no further credit was given.

Question 4 (b)(iii)

This question assessed the candidates ability to read values from a graph and use them to calculate a rate. Most candidates were able to correctly read the values and determine that 32 bubbles had been released. Most candidates were also able to divide the number of bubbles by the time taken to calculate the rate.

(iii) Calculate the rate of bubble production from 0 minutes to 8 minutes when the yeast is at 37 °C.

(2)

rate = no. of bubbles / time

= 16 / 8 = 2

rate of bubble production = 2 bubbles per minute

ResultsPlus Examiner Comments

This answer gained one mark. The number of bubbles is calculated incorrectly but the candidate has correctly divided by 8 minutes to determine the rate.

(iii) Calculate the rate of bubble production from 0 minutes to 8 minutes when the yeast is at 37 °C.

(2)

32 / 8 = 4

rate of bubble production = 4 bubbles per minute

ResultsPlus Examiner Comments

This answer gained both marks for determining the number of bubbles released and correctly dividing it by the time taken.

Question 4 (b)(iv)

This question asked candidates to explain the reasons for the change in bubble production over time as the yeast respired anaerobically. Many candidates found this question challenging and a significant number gave descriptions of the graph rather than explanations. Strong answers described the steady increase in number of bubbles until around 18 minutes when no more bubbles were produced and then explained the increase and level off in terms of there being enough glucose present for respiration until it ran out. Some candidates mistook the label on the y axis for rate and suggested that the rate levelled off rather than the fact that no more bubbles were produced.

(iv) Explain the change in the total number of bubbles produced from 0 minutes to 20 minutes at 25 °C.

(2)

For the first 16 minutes, 2 bubbles are produced per minute. However, after the 16+2 minute, there is less glucose and thus the rate slows to one bubble per minute. After the 18th minute, all glucose has been used and no more bubbles are produced

ResultsPlus
Examiner Comments

This answer was awarded two marks for the correct description of the increase until 16 minutes when it began to level off and the idea that the glucose has eventually been used up.

(iv) Explain the change in the total number of bubbles produced from 0 minutes to 20 minutes at 25 °C.

(2)

The total number of bubbles produced were increasing at a constant rate from 0 to 18 minutes but stopped producing anymore bubbles from 18 to 20 minutes

ResultsPlus
Examiner Comments

This answer gained one mark for the description of the increase and level off but no explanation is given.

(iv) Explain the change in the total number of bubbles produced from 0 minutes to 20 minutes at 25 °C.

(2)

~~from 0 minutes to 8~~ The total number of bubbles are continuously increasing as the time increases because the yeast is respiring and producing CO_2, which reaction stops at 16 min because it runs out of substrate ie reaction stops / respiration stops

ResultsPlus
Examiner Comments

This answer gained two marks for correctly describing the increase and level off and explaining that the graph levels off as glucose has run out.

Question 4 (b)(v)

There were many excellent answers to this question about the effects of increasing temperature on the rate of bubble production, but there were also a number of candidates who did not interpret the data correctly. Strong answers explained that increasing the temperature increased the rate of respiration as particles would have more kinetic energy and so there would be more enzyme-substrate collisions. Only a minority of candidates recognised that at 37 °C, the rate was faster and also levelled off more quickly as the glucose ran out.

(v) Explain the difference in the rate of bubble production between 0 and 10 minutes at 37 °C compared with 25 °C.

(3)

At 37°c, the rate of bubble production is higher as the slope is steeper. ~~At 10 minutes, the rate of bubble production is constant, meaning that the reaction has finished.~~ ~~The~~ At higher temperatures, yeast cells gain more KE and they respire faster, therefore, more bubbles are formed.

ResultsPlus
Examiner Comments

This answer gained two marks. The candidate states that there is more kinetic energy and then explains that this causes the rate of respiration to increase.

(v) Explain the difference in the rate of bubble production between 0 and 10 minutes at 37 °C compared with 25 °C.

(3)

Greater amounts of bubble were produced in at 37°C than 25°C this may be because yeast work better at higher temperatures. At first 8 minute double the amount of bubble, were produced in 37°C (32), while only 16 were produced at 25°C.

ResultsPlus
Examiner Comments

This answer gained no credit. The candidate has not given any explanation for the change in rate of reaction and has only given a description of the data.

(v) Explain the difference in the rate of bubble production between 0 and 10 minutes at 37 °C compared with 25 °C.

(3)

yeast in glucose solution ~~prot~~ has a higher rate of bubble production in 37°C compared to 25°C between 0 and 10 minutes. This is resulted as enzyme in yeast gain more kinetic energy in higher temperature to increase the chance of collision between substrate to form enzyme substrate complex

ResultsPlus
Examiner Comments

This answer gained two marks for explaining that there is more kinetic energy so that there are more chances of collision between enzymes and substrates.

(v) Explain the difference in the rate of bubble production between 0 and 10 minutes at 37 °C compared with 25 °C.

(3)

The total number of bubbles produced increases rapidly in the first 8 minutes, rises a little from the 8th to 9th minute and levels off after 10 minutes. The number of bubbles produced increases rapidly because 37 °C is the optimum temperature for enzymes, so they move the fastest, increasing the rate of successful collisions, and that it levels off because all the glucose in the solution is used up. The curve of the temperature of 25 °C levels off slower than the one at 37 °C because the enzymes move slower in a lower temperature, thus glucose is used up more slowly.

ResultsPlus
Examiner Comments

This excellent answer gained all three marks. The candidate has stated that the temperature is closer to the optimum for enzymes, there are more collision and that the glucose runs out faster when at 37 °C.

(v) Explain the difference in the rate of bubble production between 0 and 10 minutes at 37 °C compared with 25 °C.

(3)

The rate of production is higher at 37°C than 25°C as enzymes in yeast have more kinetic energy and the rate of respiration increases due to increased metabolism. More carbon dioxide is produced in a fixed amount of time so the rate increases.

ResultsPlus
Examiner Comments

This answer gained two marks for the increase in kinetic energy and the increase in rate of respiration.

(v) Explain the difference in the rate of bubble production between 0 and 10 minutes at 37 °C compared with 25 °C.

(3)

✱ At 37° C the enzymes in the yeast are working much closer to their optimum meaning they have more kinetic energy for more successful collision between enzyme and substrate. Therefore the rate of respiration is much higher with the yeast at 37°C compared to 25°C which is below their optimum

ResultsPlus
Examiner Comments

This excellent answer gained three marks for the increase in kinetic energy, the increase in number of collisions and the increase in respiration.

Question 4 (b)(vi)

This question assessed the candidates knowledge of practical methods and how the accuracy of the experiment could be improved. Strong candidates recognised that counting bubbles is inaccurate and that a better method would be to collect a volume of gas in a syringe or measuring cylinder. A significant number of candidates confused the term accurate with reliable and incorrectly suggested increasing the number of replicates.

(vi) Describe how the student could modify the experiment to give more accurate results.

(2)

~~repeat at each temperature more times~~ use a gas syringe rather than counting bubbles

ResultsPlus
Examiner Comments

This answer gained one mark for the idea of using a syringe. No reference is given to the collection of a volume of gas.

(vi) Describe how the student could modify the experiment to give more accurate results.

(2)

Repeat both tests at both temperatures to ensure no anomalous results. Repeat test with different temperatures. The no. of yeast cells and glucose provided should be the same

ResultsPlus
Examiner Comments

This answer gained no marks and is a typically incorrect response where the candidate has suggested that carrying out more replicates would improve accuracy.

(vi) Describe how the student could modify the experiment to give more accurate results.

concentration gradient.

(2)

The student can use a gas syringe to collect the volume of CO_2 produced instead of counting, to reduce mistakes.

ResultsPlus
Examiner Comments

This very good answer gained both marks for collecting a volume of gas in a syringe.

Question 5 (a)(ii)

Many candidates were able to gain at least one mark but fewer went on to gain both marks. Most candidates recognised that the blood vessel labelled X would contain blood with less oxygen, although a few incorrectly stated that it would contain blood with more oxygen. Fewer candidates went on to mention carbon dioxide levels in the blood vessels although a significant number incorrectly referred to blood pressures – the question asked about composition of the blood rather than pressure.

(ii) Give two differences between the composition of the blood in X and Y.

(2)

Blood in Y has much higher pressure as it carries oxygen whereas blood in X has lower pressure because it is de-oxygenated. Blood in X contains waste products whereas blood in Y doesn't.

ResultsPlus
Examiner Comments

This answer gained one mark for correctly stating that the blood in X is deoxygenated. No marks were awarded for the references to pressure.

(ii) Give two differences between the composition of the blood in X and Y.

(2)

X; pulmonary artery, gives deoxygenated blood ~~to~~ to the lungs, blood in Y, aorta, is the ~~pu~~ flows the oxygenated blood to the body.

ResultsPlus
Examiner Comments

This answer gained one mark for the correct reference to oxygen levels of the blood in the two vessels.

(ii) Give two differences between the composition of the blood in X and Y.

(2)

X contains deoxygenated blood which is high in carbon dioxide and low in oxygen.

Y contains oxygenated blood which is high in oxygen and low in carbon dioxide.

ResultsPlus
Examiner Comments

This strong answer gained two marks for stating the correct concentrations of oxygen and carbon dioxide in the two blood vessels.

Question 5 (b)(i)

This calculation required candidates to extract the correct information from the table, rearrange the formula for cardiac output, and substitute in the values. Most candidates were able to complete this calculation correctly to gain both marks. A minority of candidates selected the wrong information from the table and used data from the untrained volunteer.

(b) A scientist investigates the effect of exercise on the heart rate of two people.

One person is a trained athlete and the other is an untrained volunteer.

The heart rates of both individuals are measured at rest (0 minutes). Both individuals then exercise for six minutes and then rest for another six minutes.

The table shows the heart rates of the untrained volunteer and the trained athlete at rest, during and after exercise.

x y

Time in minutes	Heart rate in beats per minute (bpm)	
	untrained volunteer	trained athlete
0 (rest)	65	55
2	120	95
4	130	115
6	150	135
10	100	80
12	80	60

(i) The cardiac output is the volume of blood pumped out by the left ventricle in one minute.

The stroke volume is the volume of blood pumped out by the left ventricle in one beat.

The cardiac output of a resting human is 4900 cm^3 per minute.

Calculate the stroke volume of the trained athlete when at rest when their cardiac output is 4900 cm^3 per minute.

Use this formula.

cardiac output = stroke volume × heart rate

(2)

$4900 = X \times 55$

stroke volume = $\frac{4900}{55} = 89.090909$

stroke volume = 89.1 ..... cm^3

ResultsPlus
Examiner Comments

This correct answer gained two marks. The working is shown very clearly – an example of good practice.

(b) A scientist investigates the effect of exercise on the heart rate of two people.

One person is a trained athlete and the other is an untrained volunteer.

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Calculate the stroke volume of the trained athlete when at rest when their cardiac output is 4900 cm^3 per minute.

Use this formula.

cardiac output = stroke volume × heart rate

(2)

Stroke volume = $\frac{\text{cardiac output}}{\text{heartrate}}$

SV = $\frac{4900}{65}$ = 75.38 = $\frac{980}{13}$

stroke volume = 75.38 = $\frac{980}{13}$ cm^3

ResultsPlus
Examiner Comments

This answer gained one mark. The working is correct but the candidate has selected the wrong data from the table.

(b) A scientist investigates the effect of exercise on the heart rate of two people.

One person is a trained athlete and the other is an untrained volunteer.

The heart rates of both individuals are measured at rest (0 minutes). Both individuals then exercise for six minutes and then rest for another six minutes.

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The cardiac output of a resting human is 4900 cm^3 per minute.

Calculate the stroke volume of the trained athlete when at rest when their cardiac output is 4900 cm^3 per minute.

Use this formula.

cardiac output = stroke volume × heart rate

C

V H

Stroke volume = cardiac output ÷ heart rate (2)

4900 x 55 = 269500

stroke volume = 269500 cm^3

ResultsPlus
Examiner Comments

This answer gained one mark as the candidate has selected the correct data from the table.

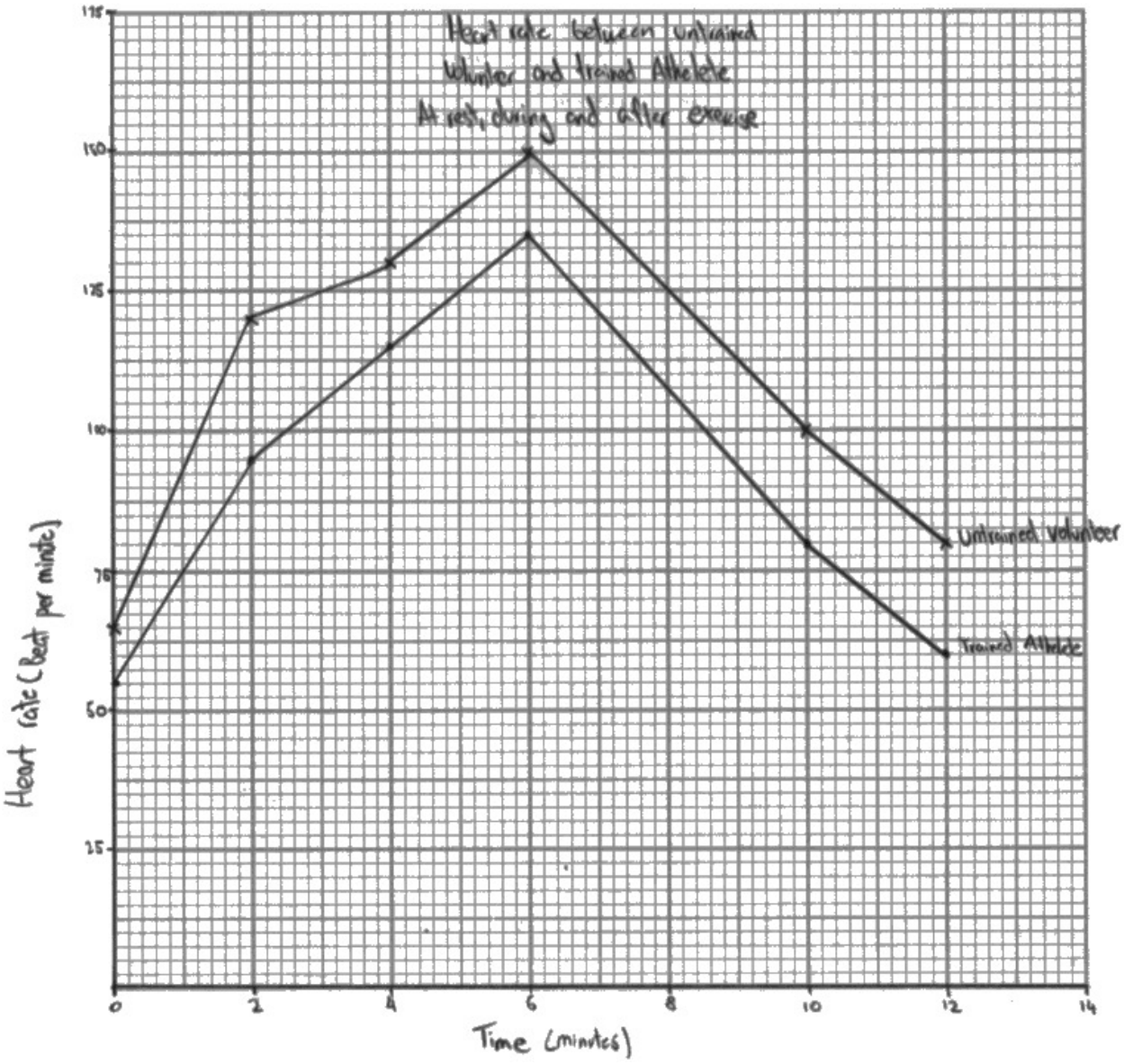
Question 5 (b)(ii)

Graph plotting was generally excellent, and most candidates are able to gain at least three marks. The graph required linear horizontal and vertical axes – some candidates did not use a linear horizontal axis (the data for time went up in uneven increments). Most candidates were able to label the axes correctly and labelled the lines. Most candidates were also able to join points with straight lines. A small number drew bar charts – candidates should be careful to read questions thoroughly as this question asked for a line graph.

(ii) **Plot a graph to show the heart rate of the untrained volunteer and the trained athlete when resting and during exercise from 0 minutes (when at rest) to 12 minutes.**

Use a ruler to join the points with straight lines.

(5)



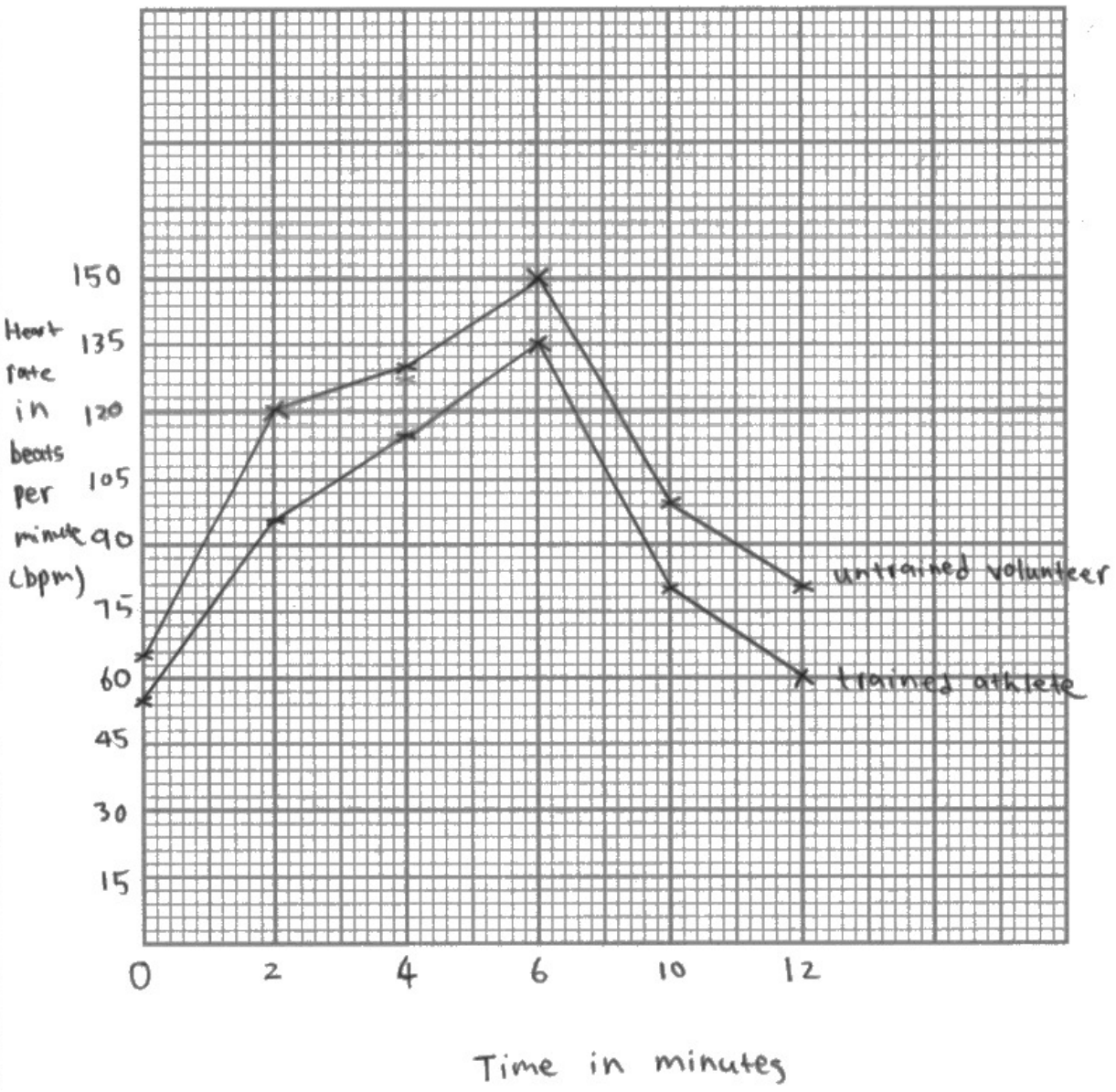
ResultsPlus
Examiner Comments

This excellent graph gained all five marks. The scales used are all linear and the axes are labelled. Points are plotted correctly and joined with straight lines which are not extrapolated. Both lines are also clearly labelled.

(ii) Plot a graph to show the heart rate of the untrained volunteer and the trained athlete when resting and during exercise from 0 minutes (when at rest) to 12 minutes.

Use a ruler to join the points with straight lines.

(5)



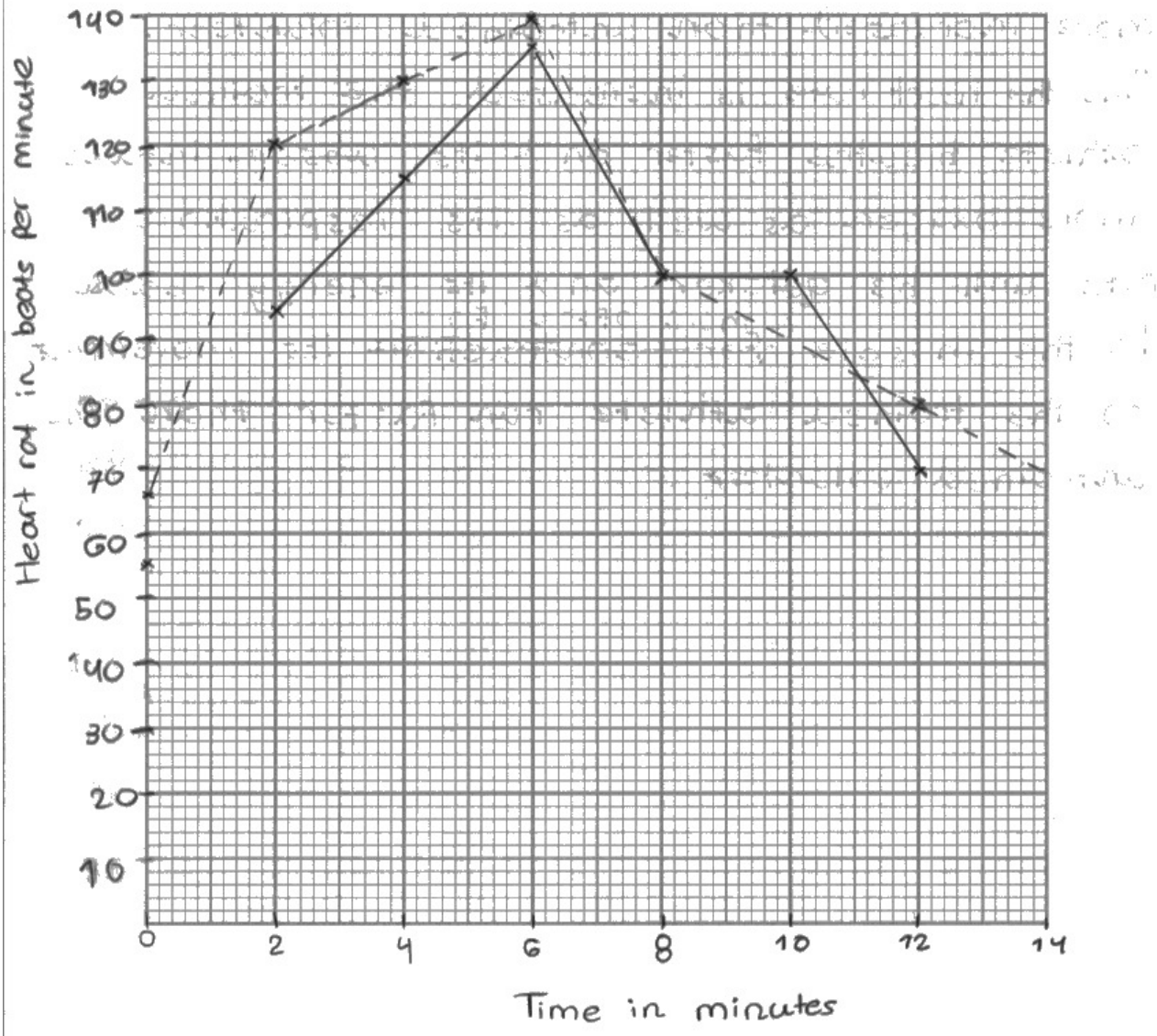
ResultsPlus
Examiner Comments

This graph gained four marks. The axes are labelled, points are plotted correctly and joined with ruled, straight lines and the lines are labelled. The horizontal scale is not linear so only four marks are awarded in total.

(ii) Plot a graph to show the heart rate of the untrained volunteer and the trained athlete when resting and during exercise from 0 minutes (when at rest) to 12 minutes.

Use a ruler to join the points with straight lines.

(5)



--- = untrained volunteer

——— = trained athlete

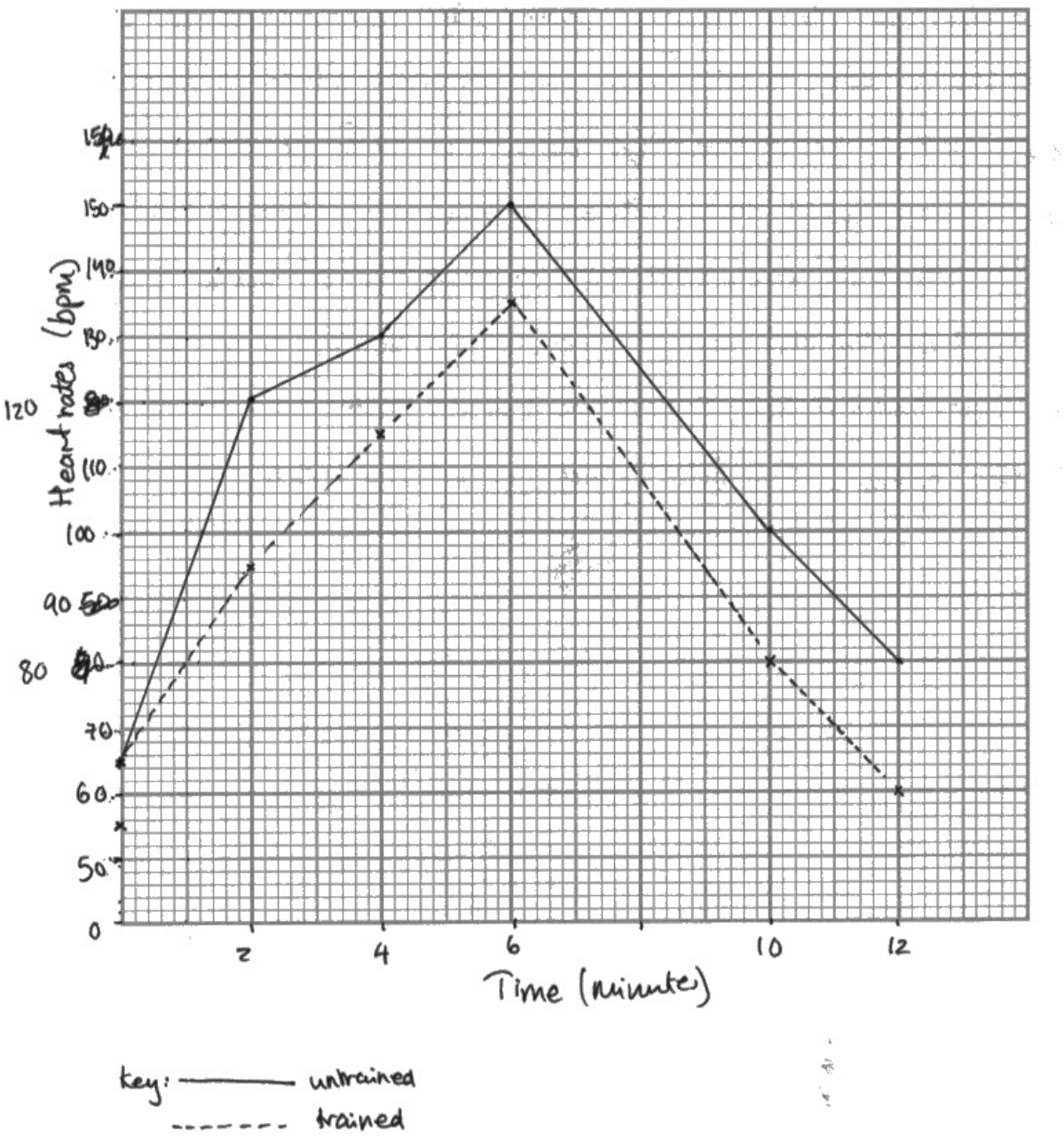
ResultsPlus
Examiner Comments

This graph gained three marks for the linear axes, labels and key. The plots are not correct and the plots are not joined correctly.

(ii) Plot a graph to show the heart rate of the untrained volunteer and the trained athlete when resting and during exercise from 0 minutes (when at rest) to 12 minutes.

Use a ruler to join the points with straight lines.

(5)



ResultsPlus
Examiner Comments

This graph was awarded four marks. One of the plots is incorrect so the plotting mark was not given.

Question 5 (b)(iii)

This longer question required candidates to analyse the information in the table and their graph to explain why the trained athlete can run faster than the untrained athlete. Many candidates found the question challenging but there were also many excellent, detailed, and accurate answers seen. Strong answers explained that the pulse rate of the trained athlete was lower so the heart must pump more blood each beat. These stronger answers then went on to explain that the trained athlete would be able to transfer more oxygen to muscles for respiration and muscle contraction. Weaker answers tended to be confused, often suggesting that the trained athlete did not need as much oxygen, had lower respiration rates, or could control their heart rate. Some answers showed confusion about the differences between aerobic and anaerobic respiration.

(iii) Explain why the trained athlete can run faster than the untrained volunteer.

Use the information in the table to support your answer.

(4)

the athlete heart rate increase slower than untrained volunteer
~~which athlete stroke volume will be higher~~
the athlete heart rate recovery faster than volunteer as
after 6 minutes rest the heart rate is almost back to normal
but the volunteer heart rate is much higher than heart rate in rest
the volunteer ~~maximum~~ heart rate pump to 150 after 6 minutes training
which athlete bpm is just 135 which mean he avoid
more training.
the speed of athlete bpm, increase and decrease is ~~no~~ more average
as the graph ~~show~~ just, like just two lines, but the
volunteer bpm increase in three different lines.

ResultsPlus
Examiner Comments

This answer gained one mark. The candidate correctly states that the heart rate of the trained athlete recovers faster. No explanations are given so no more credit is awarded.

(iii) Explain why the trained athlete can run faster than the untrained volunteer.

Use the information in the table to support your answer.

(4)

The amount of blood the trained athlete can pump to working muscles. is more than the untrained volunteer. The heart rate of the trained athlete is far less than the untrained volunteer. meaning the trained athlete has a stronger heart. A stronger heart can supply more oxygen to working muscles allowing muscles to contract more and giving the trained athlete the advantage of better muscle contraction. A better muscle contraction means the muscles that are used during sprinting can generate more force. The amount of blood that the untrained volunteer athlete can pump is ~~tesser~~ less than the ~~the~~ trained athlete. Meaning less oxygen can be transported to working muscles each pump.

ResultsPlus
Examiner Comments

This answer gained four marks. The candidate states that the trained athlete was able to pump more blood each beat, can transfer more oxygen, recovers faster and can contract muscles more. Note that mention of muscles is not enough for the mark – they need to be contracting.

(iii) Explain why the trained athlete can run faster than the untrained volunteer.

Use the information in the table to support your answer.

(4)

Trained athlete has an overall lower heart rate and faster recovery time meaning that ~~less~~ the lactic acid produced by anaerobic respiration (when oxygen was limited) is removed more quickly and the oxygen debt is payed.
A lower heart rate means that he has ~~a~~ lower blood pressure

ResultsPlus
Examiner Comments

This answer gained two marks for the lower heart rate in the trained athlete and the idea of reduced oxygen debt.

(iii) Explain why the trained athlete can run faster than the untrained volunteer.

Use the information in the table to support your answer.

(4)

The trained athlete is more fit and has a larger volume of blood pumped by the heart, which allows more oxygen delivered to the muscle cells meaning more respiration and more ATP / energy ~~for produced~~ produced for muscle contractions. There is also less lactic acid produced ~~as~~ and so less cramps. The ~~athlete~~ athlete has a lower ~~resting~~ bpm and after exercise, the bpm drops back to normal quicker than the unfit person.

ResultsPlus
Examiner Comments

This answer gained four marks. The candidate has correctly stated that the trained athlete can pump a higher blood volume, can deliver more oxygen, can respire more and so can contract muscles more. They have also stated that there will be less lactic production.

(iii) Explain why the trained athlete can run faster than the untrained volunteer.

Use the information in the table to support your answer.

(4)

The trained athlete can run faster because he can give a bigger stroke volume of blood pumped by the heart, at a lower beats per minute. This enables the athletes muscles receive a greater blood flow through his muscles than the untrained volunteer. So his muscles receive greater amounts of oxygen and glucose to his muscles which are necessary for respiration. This surplus of oxygen and glucose allow for a greater rate of respiration, which translates into stronger and faster muscle contractions. This allows the athlete to run faster.

ResultsPlus
Examiner Comments

This answer gained four marks for correctly stating that the heart of the trained athlete has a bigger stroke volume, pumps at a slower speed and can pump more oxygen to muscles, which can respire faster and then contract more.

Question 6 (a)

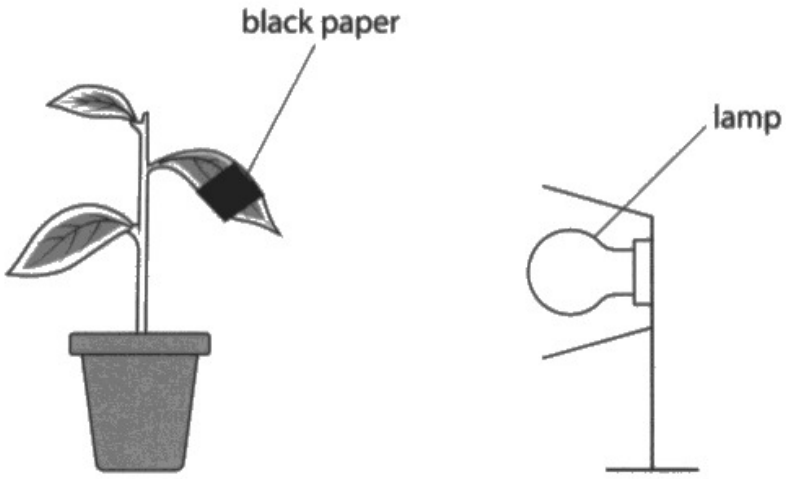
This question asked candidates to give the balanced chemical equation for photosynthesis. Most candidates gained two marks for giving the correct equation. A small number gave incorrect formulae for glucose and others did not balance the equation.

6 Variegated leaves have areas that are green and areas that are white.

A student uses this method to investigate the effect of light on photosynthesis in a variegated leaf.

- place a plant in the dark for 24 hours
- wrap a strip of black paper across a leaf
- shine light on the plant for 24 hours
- remove the black paper
- use iodine solution to test the leaf for starch

The diagram shows the apparatus the student uses.



(a) Complete the balanced chemical symbol equation for photosynthesis.

(2)

$6CO_2$ + $6H_2O$ → $C_6H_{12}O_6$ + $6O_2$

ResultsPlus
Examiner Comments

This answer gained two marks for giving the correct formula.

6 Variegated leaves have areas that are green and areas that are white.

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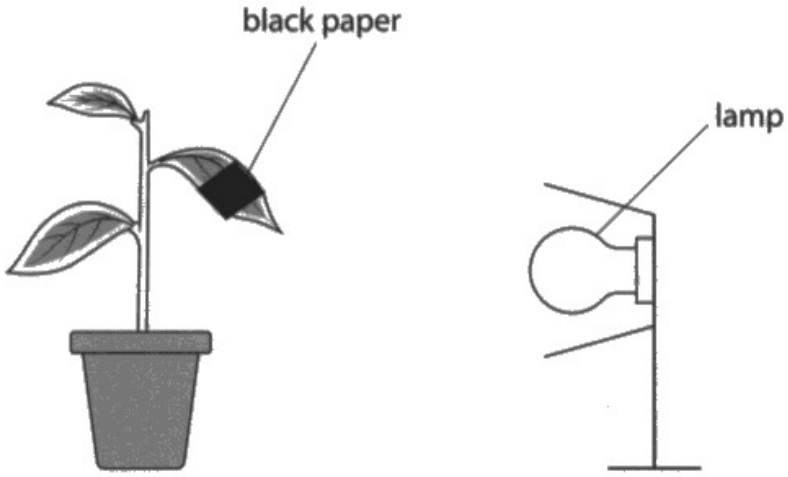

(a) Complete the balanced chemical symbol equation for photosynthesis.

(2)

$6CO_2$ + $6H_2O$ → $C_6H_{12}O_6$ + $6O_2$

ResultsPlus
Examiner Comments

This answer gained two marks for giving the correct equation.

6 Variegated leaves have areas that are green and areas that are white.

A student uses this method to investigate the effect of light on photosynthesis in a variegated leaf.

- place a plant in the dark for 24 hours
- wrap a strip of black paper across a leaf
- shine light on the plant for 24 hours
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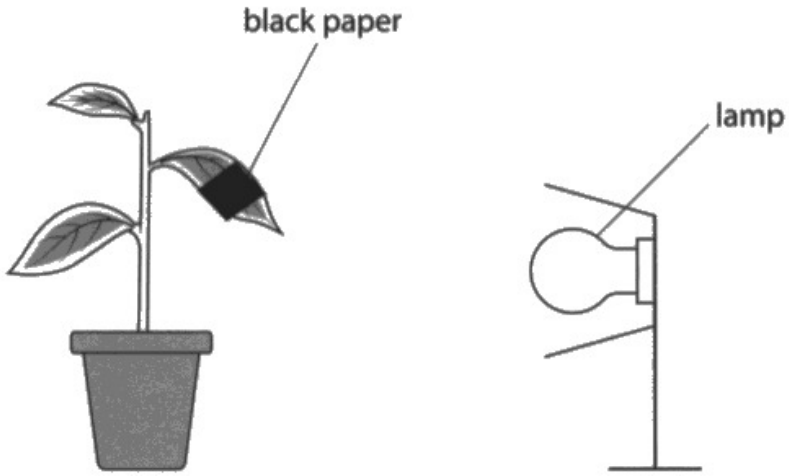
The diagram shows the apparatus the student uses.



(a) Complete the balanced chemical symbol equation for photosynthesis.

(2)

$6CO_2$ + $6H_2O$ → $C_6H_{12}O_6$ + $6O_2$

ResultsPlus
Examiner Comments

This answer gained no marks as the formula for glucose is incorrect.

Question 6 (b)(i)

This question tested the candidates understanding of the need to destarch plants before testing the effects of light and chlorophyll on starch production. Around half of the candidates correctly referred to the removal of starch or destarching the plant. Some candidates simply stated that by placing the plant in the dark, it would not be able to photosynthesise – this was not quite enough to gain the mark as the idea of starch removal was needed.

(b) (i) State why the plant was placed in the dark for 24 hours.

(1)

To let the plant stop doing photosynthesis so that the experiment can be fair.

ResultsPlus
Examiner Comments

This answer did not gain the mark as, although the candidate recognises that the plant would not be able to photosynthesis, there is not mention of starch removal.

(b) (i) State why the plant was placed in the dark for 24 hours.

(1)

To destarch the plant [illegible]

ResultsPlus
Examiner Comments

This answer gained one mark for the idea of destarching the plant.

(b) (i) State why the plant was placed in the dark for 24 hours.

(1)

- to ensure all starch is used up and only starch tested was made during the experiment.

ResultsPlus
Examiner Comments

This answer gained one mark for correctly stating that the starch would be removed.

Question 6 (b)(ii)

In this question, candidates had to shade in or label areas of the leaf that would contain starch. Most were able to recognise that the areas with chlorophyll that were exposed to light would contain starch. Some candidates did not appreciate that both chlorophyll and light were required and so shaded areas with chlorophyll that were under the card.

(ii) Diagram 1 shows the position of the black paper on the leaf.

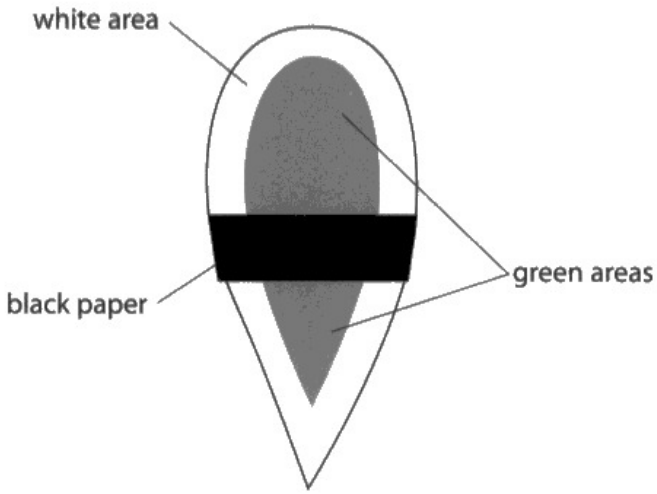
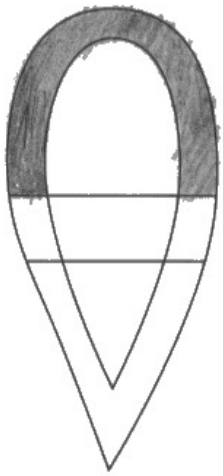


Diagram 1

Complete diagram 2 to show where the variegated leaf would appear black after testing with iodine solution.

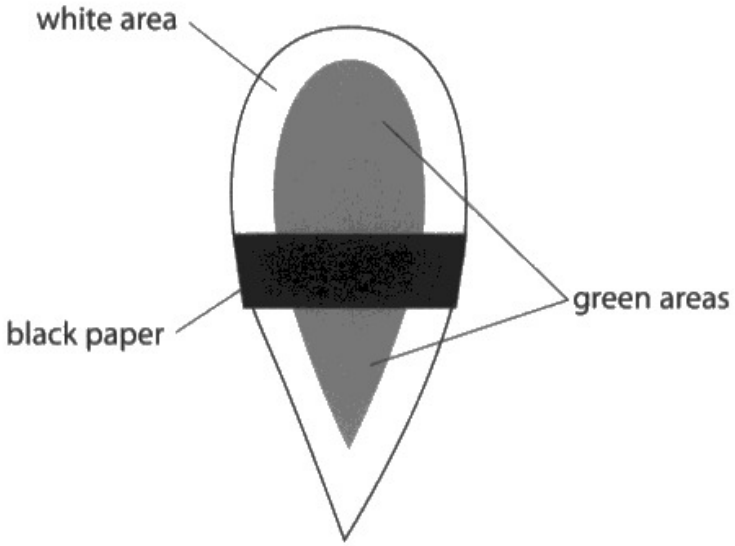
(2)



ResultsPlus
Examiner Comments

This answer gained one mark for not shading the area under the card.

(ii) Diagram 1 shows the position of the black paper on the leaf.



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Complete diagram 2 to show where the variegated leaf would appear black after testing with iodine solution.

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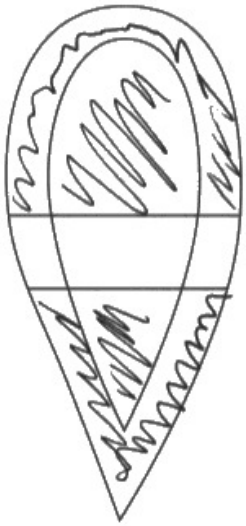

ResultsPlus
Examiner Comments

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(ii) Diagram 1 shows the position of the black paper on the leaf.

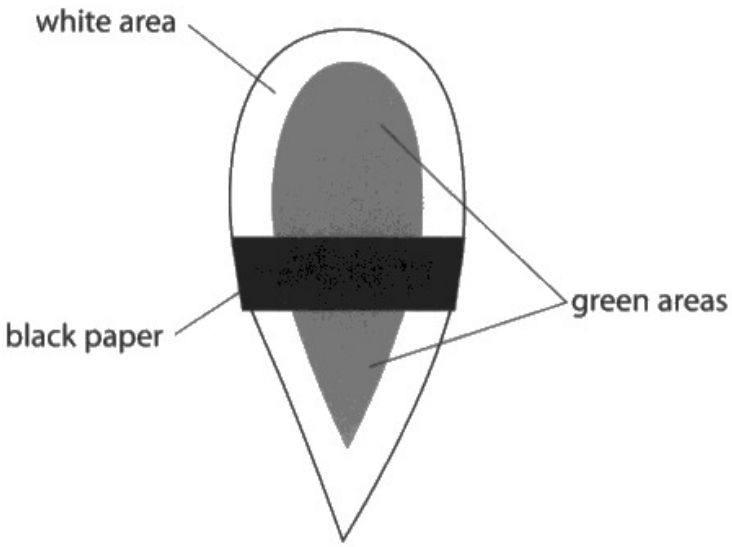
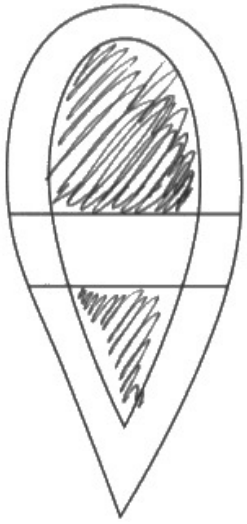


Diagram 1

Complete diagram 2 to show where the variegated leaf would appear black after testing with iodine solution.

(2)



ResultsPlus
Examiner Comments

This answer gained two marks for correctly shading areas with chlorophyll that were in the light.

Question 6 (c)

This question tested candidates experimental planning by asking them to plan an experiment to test the effect of light intensity on the leaves of ivy plants. The mark scheme required candidates to change the light intensity (C), control a characteristic of the ivy such as age (O), carry out repeats (R), measure a feature of the leaves after a stated time (M1, M2) and control abiotic variables that would affect the plant growth (S1, S2). Many candidates produced excellent plans and gained at least four marks with many going on to gain all six. Key points that candidates should remember for future series are:

- give specific features of the organism that are controlled such as species, age, mass.
- do not suggest repeats at more values of the independent variable, the idea of the repeats is for increasing reliability by repeating at the same values.
- when suggesting ways of measuring the dependent variable, give measurable features eg length, volume, mass rather than amount and give a stated time.
- make sure that other control variables are relevant to the experiment.

(c) The student observes that the leaves on different ivy plants seem to be ~~different~~ sizes depending on the amount of ~~sunlight~~ the plants receive.

Design an investigation to test whether the amount of sunlight received by ivy plants affects the size of their leaves.

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

(6)

I will measure the size of the ivy plants' leaves ~~##~~ before shining light and after shining light. I will use a metre ruler / measuring tape to measure the diameter and length ~~of~~ / size of each leaf.

I will change the amount of sunlight received by placing the leaves / plants at different distances from the window / sunlight source. For example one plant at each distance (10m, 15m, 20m, 25m, 30m).

I will keep the same initial size of the leaves, same species of ivy plants, same age of leaves / ivy plants, same amount of water provided, same surrounding temperature / warmth, same moisture of air and same nutrients (e.g. glucose, nitrates, etc) supplied.

I will calculate the difference in size by subtracting the final measurements / data with the initial measurements / data of each leaf. I will compare the difference in results.

I will repeat this 3 times using different ivy plants each time to find the average.

ResultsPlus
Examiner Comments

This answer gained all six marks. The candidate clearly states that the light intensity will be varied (and gives a method), the way that the leaves will be measured is given (length), the ivy is controlled (same starting size of leaves), two relevant abiotic controls and repeats (C, O, R, M1, S1, S2).

(c) The student observes that the leaves on different ivy plants seem to be different sizes depending on the amount of sunlight the plants receive.

Design an investigation to test whether the amount of sunlight received by ivy plants affects the size of their leaves.

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

(6)

The light intensity should be changed, which can be done by placing a lamp in front of the ivy and moving it back every 5 cm. The ~~organism~~ used should be of the same species of ivy plant. The experiment should be repeated at least 3 times. The size of the leaves should be measured using a ruler as well as the time taken for the ~~experiment~~ experiments, which should be 1 week. The ~~temperature~~ temperature as well as the pH of the soil should be kept the same.

(Total for Question 6 = 11 marks)

C - light intensity

O - same species of ivy

R - 3 times

M - size of leaves using ruler

M - 1 week

S - Temperature

S - water (pH of soil

ResultsPlus
Examiner Comments

This answer gained six marks. The candidate has also planned their answer at the bottom of the page using C, O, R, M, S – this is good practice and should be encouraged.

The marks are:

C – same light intensity.

O – same species of plant.

R – repeats.

M1 – measure using a ruler (measure size alone would not gain the mark).

M2 – left for one week.

S1 & S2 – control temperature and pH.

ResultsPlus
Examiner Tip

Plan these style of questions using C, O, R, M, S but give your answer in the context of a whole experiment with full detail.

(c) The student observes that the leaves on different ivy plants seem to be different sizes depending on the amount of sunlight the plants receive.

Design an investigation to test whether the amount of sunlight received by ivy plants affects the size of their leaves.

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

(6)

Prepare two different plants. Place them both in dark for 24 hours. Keep the same temperature for two plants, give them same amount of water. After 24 hours, place plant A under strong sunlight and place plant B in a place that is dim. Measure the leaf size of both plants for one week and compare the results.

ResultsPlus
Examiner Comments

This answer gained five marks for:

C: changing the light intensity.

O: plants both left in dark for 24hr.

S1 and S2: same temperature and water.

M2: left for one week.

M1 is not given as not a length or mass etc.

(c) The student observes that the leaves on different ivy plants seem to be different sizes depending on the amount of sunlight the plants receive.

Design an investigation to test whether the amount of sunlight received by ivy plants affects the size of their leaves.

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

(6)

~~Shine~~

~~the light at on the plant.~~

~~Count~~ You first shine the light on the plant and measure the size of leaves. You need to repeat the experiment for serval times. You need to change the distance from the light and the plant. The experiment must be in a state @ time. The concentration of the CO_2 must be the same. You need to use the same type of plant.

ResultsPlus
Examiner Comments

This answer gained four marks for:

C: changing the light intensity.

S1: controlling the carbon dioxide.

O: controlling the species of plant.

R: repeats.

Question 7 (a)(ii)

This question tested the candidates factual knowledge of the role of hormones in the menstrual cycle. Most candidates were able to state that oestrogen repairs the uterus lining and most went on to state that progesterone maintains the lining. Some candidates referred to FSH and LH and egg maturation. FSH and LH are emboldened topics in the specification so cannot be tested on Paper 1. The question also asked about how oestrogen and progesterone affect the uterus so other effects of the hormones were not relevant.

(ii) State how oestrogen and progesterone affect structure C during the menstrual cycle.

(2)

oestrogen

causes the lining of uterus to thicken

progesterone

~~The~~ stimulates the breaking down of the uterus lining

ResultsPlus
Examiner Comments

This answer gained one mark for the correct function of oestrogen. The answer given for the role of progesterone is incorrect.

(ii) State how oestrogen and progesterone affect structure C during the menstrual cycle.

(2)

oestrogen

Builds up the uterus lining

progesterone

Maintains the uterus lining

ResultsPlus
Examiner Comments

This answer gained two marks as the candidate has correctly given the role of oestrogen in repairing the uterus lining and the role of progesterone in maintaining the lining.

Question 7 (b)(i)

This question asked candidates to explain how an embryo is formed after sperm and egg meet. Many candidates correctly stated that the gametes fuse and produce a zygote. A significant number also went on to state that the zygote then undergoes mitosis. Some candidates incorrectly suggested that meiosis occurs to produce other cells.

(b) *In vitro* fertilisation (IVF) is used to help some people have children.

Eggs are mixed with sperm in a laboratory.

Embryos are then transferred into a uterus.

(i) Describe how an embryo forms after the eggs and sperm have been mixed together.

(2)

~~The cells~~ The zygote undergoes mitosis and becomes an embryo ~~which~~ which develops in the womb

ResultsPlus
Examiner Comments

This answer gained two marks for correctly stating that a zygote will undergo mitosis to produce an embryo.

(b) *In vitro* fertilisation (IVF) is used to help some people have children.

Eggs are mixed with sperm in a laboratory.

Embryos are then transferred into a uterus.

(i) Describe how an embryo forms after the eggs and sperm have been mixed together.

(2)

Embryo forms when fertilisation occurs in the fallopian tube as the egg cell and sperm cell gametes fuse together.

ResultsPlus
Examiner Comments

This answer gained one mark for correctly stating that the sperm and egg fuse together.

(b) *In vitro* fertilisation (IVF) is used to help some people have children.

Eggs are mixed with sperm in a laboratory.

Embryos are then transferred into a uterus.

(i) Describe how an embryo forms after the eggs and sperm have been mixed together.

(2)

The sperm ~~egg~~ fertilises the egg and their nuclei fuse to form a zygote, which has a diploid number of chromosomes (46). The zygote divides by mitosis to form an embryo.

ResultsPlus
Examiner Comments

This excellent answer gained two marks for correctly stating that the egg and sperm fuse to form a zygote which divides by mitosis.

ResultsPlus
Examiner Tip

Do not confuse mitosis and meiosis and make sure that the spelling of them is correct.

Question 7 (b)(ii)

This question was a challenging question that required candidates to look at two sets of data about IVF. One graph showed the effect of limiting the number of embryos that can be transferred on the number of multiple births, and the table demonstrated the effect of age on the success of IVF. Candidates were asked to discuss the effects of limiting the number of embryos transferred. Many candidates gained at least three marks but only the strongest answers gained all five. Many candidates recognised that the number of multiple births had declined over time and strong answers went on to state that there had been a sharp decrease after the restrictions had been brought in. Only a few candidates pointed out the numbers of multiple births before the restrictions were fairly stable. Candidates should always try to give as much detail as possible when describing trends and patterns in data. Most candidates were able to describe the decrease in success of IVF but only a minority went on to explain that this is why older women are allowed to have more than one embryo transferred. Candidates should always consider the quality of the experimental design. In this question, many did comment on the design, pointing out that there was no information on sample sizes, other health factors of the mothers or sperm quality. Weaker answers tended to gain up to two marks, often for describing basic patterns in the number of multiple births and the effect of age on success.

Discuss the effects of limiting the number of embryos transferred.

Use the information in the table and the graph to support your answer.

(5)

As shown on the graph, after 2007 when the number of embryos transferred was limited, the percentage of multiple births steeply decreased from 23% (2007) to 6% (2019), whereas before 2007, the percentage remained fairly constant with a slow decline. The limit of embryo's transferred to a person over 40 is more (2) than a younger person (1), since, as shown by the table the success rate of IVF decreases as a person gets older. Person age 35 to 37 has 28% success rate, a person aged 40 to 42 has success rate of 11%. Therefore a person over 40 needs to be transferred more embryos in order to increase the likely hood of producing a baby.

However, there is no mention of other factors that could lead to a lower production of baby such as:

- drug habits, alcohol use, smoking, diet health issues (that are more likely at an older age).

There is no mention for the number of people tested, should be repeated with multiple groups, and in different countries.

ResultsPlus
Examiner Comments

This excellent answer gained five marks. The candidate has explained that the number of multiple births decreases and decreases more sharply after 2007. They have correctly described the effect of age on success rates and linked it to the need for transferring more embryos in older women. In the second paragraph, the candidate clearly explains that there may be other health factors and that the sample size is unknown.

ResultsPlus
Examiner Tip

When answering discussion questions, always describe detailed patterns in data, suggest explanations and comment on the experimental design.

Discuss the effects of limiting the number of embryos transferred.

Use the information in the table and the graph to support your answer.

(5)

- limiting number of embryos caused a ~~die~~ decrease in perctentage of multiple births
- Multiple births from IVF treatments steadily decreased
- Only one embryo planted in person under 30 as they are more fertile.
- Highest percentage of IVF treatment that produced a baby are under 35, because the embryo develops better due to steady hormones.
- Least ~~number of~~ percentage in people that are 45 to 50 due to hormone imbalance as they are closer to menopause.
- Percentage of IVF ~~too~~ treatments that lead to multiple births greatly decreased after 2007.
- It decreased slowly and increase slightly from 1993 to 2005 / 2007.

ResultsPlus
Examiner Comments

This is another example of an answer that gained five marks. The candidate states that the number of multiple births decreases over time and that as age increases, success decreases. Later in the answer, the candidate correctly refers to the steady decrease until 2007, followed by a sharp decrease. A mark is also given for the converse idea of two embryos are transferred in older women linked to success rate.

Discuss the effects of limiting the number of embryos transferred.

Use the information in the table and the graph to support your answer.

(5)

- Percentage of IVF treatments that led to multiple births decreases as year increases
- The younger the person is, the higher the success rate of IVF treatments that produced a baby
- older people have older gametes
- uterus wall not strong enough
- no information on ~~how~~ the number of people per group
- more embryos placed into the uterus, higher the chance of losing the baby
- no ~~information~~ information on peoples' health conditions, ~~age~~ mass and diet

ResultsPlus
Examiner Comments

This answer gained three marks. The candidate states that the number of multiple births decreases, that success decreases with increasing age and that there may be other factors affecting the results.

Discuss the effects of limiting the number of embryos transferred.

Use the information in the table and the graph to support your answer.

(5)

The graph shows that by limiting the number of embryos transferred, the percentage of IUF treatments which led to multiple births also decreased. However, whilst this is true, the graph shows that in 2005 and 2008, the percentage of multiple births increased during that year. After 2008, the percentage of treatments with multiple births decreased. The table shows that by limiting the embryos transferred by age, the percentage of treatments decreased. This is shown in the table, as it says that under 35 there was 32% of babies produced, but at 45 to 50, there was only 4% of babies produced. However, the results may be inconclusive / unreliable since they do not take into account other factors, such as smoking, which would affect if a baby is produced. The experiment was also not repeated more than once. The graphs and table also do not specify whether the same amount of IVF was used for each patient.

ResultsPlus
Examiner Comments

This answer gained five marks. The candidate clearly describes the decrease in number of multiple births and goes on to decrease the steeper decrease after 2007. The candidate also explains that increasing age decreases the success of IVF and that other factors may affect the data and that reliability is lacking as there are no repeats.

Discuss the effects of limiting the number of embryos transferred.

Use the information in the table and the graph to support your answer.

(5)

By liriting the number of embryos that are allowed to be transferred in younger women, this means that the birth rate in that country could be signiticantly reduced, this could prove to be harmful for ~~an underpopulat~~ a country with a declining or underpopulated society. As when women get older they begin to lose their ability to give birth, so allowing older women to be able to plant two embryos may prove to be pointless. ~~as we~~ As we can see from the data table, women above the age of 40 have a much lower percentage of giving birth to a baby through IVF treatments, averaging a 6% chance.

ResultsPlus
Examiner Comments

This answer gained two marks for correctly stating that IVF success decreases with age and that this is compensated for by allowing more than one embryo to be transferred.

Question 8 (a)(ii)

Most candidates were able to correctly state that process W in the carbon cycle is photosynthesis. A few candidates suggested that the process was respiration or combustion.

(ii) Give the name of the process labelled W.

(1)

decomposition

ResultsPlus
Examiner Comments

This answer is an example of an incorrect response that did not gain the mark.

(ii) Give the name of the process labelled W.

(1)

photosynthesis

ResultsPlus
Examiner Comments

This answer gained one mark for correctly stating that the process is photosynthesis.

Question 8 (b)(i)

This question asked candidates to name a greenhouse gas, other than carbon dioxide, methane, or nitrous oxide. Many candidates found this question challenging, stating carbon monoxide or sulfur dioxide. The most common correct answer was CFCs.

(b) Carbon dioxide, methane, and nitrous oxide are three greenhouse gases.

The table shows a comparison of these greenhouse gases.

The Global Warming Potential (GWP) is the ratio of the heat absorbed by a greenhouse gas in the atmosphere relative to the heat absorbed by the same mass of carbon dioxide gas.

Greenhouse gas	Percentage of all greenhouse gas emissions (%)	Global Warming Potential (GWP)	Length of time gas stays in atmosphere in years
carbon dioxide	77.00	1	1000
methane	16.00	30	25
nitrous oxide	0.77	270	298

(i) Name one other greenhouse gas.

(1)

CFCs (Chlorofluorocarbons)

ResultsPlus
Examiner Comments

This answer gained one mark for correctly stating CFCs.

(b) Carbon dioxide, methane, and nitrous oxide are three greenhouse gases.

The table shows a comparison of these greenhouse gases.

The Global Warming Potential (GWP) is the ratio of the heat absorbed by a greenhouse gas in the atmosphere relative to the heat absorbed by the same mass of carbon dioxide gas.

Greenhouse gas	Percentage of all greenhouse gas emissions (%)	Global Warming Potential (GWP)	Length of time gas stays in atmosphere in years
carbon dioxide	77.00	1	1000
methane	16.00	30	25
nitrous oxide	0.77	270	298

(i) Name one other greenhouse gas.

(1)

water vapor

ResultsPlus
Examiner Comments

This is another example of a correct answer, water vapour, that gained one mark.

Question 8 (b)(ii)

This question presented candidates with data on three greenhouses gases and asked for them to evaluate it to identify which of the gases would give the biggest contribution to global warming. Many excellent answers were seen that identified carbon dioxide as the most likely gas and supported this with evidence such as the length of time it persists and the amount released. The strongest answers fully evaluated the data, stating that carbon dioxide had the lowest global warming potential and went on to evaluate the contributions of nitrous oxide and methane. Candidates should be careful when writing their answers to not simply quote data but use it. For example, it was not enough to state that 'carbon dioxide is 77% of all greenhouse gas emissions' but a mark would be gained for pointing out that carbon dioxide is the highest of all greenhouse gas emissions. When evaluating data, candidates should also explore both sides of an argument or give data to support and to counter a conclusion. Weaker answers tended to gain up to two marks and often only explored one or two aspects of the data.

(ii) Evaluate the information in the table to identify which of these gases is likely to contribute most to global warming.

(5)

carbon dioxide, it is far by the most produced greenhouse gas, even if the GWP is low, the sheer amount of carbon dioxide produced globally overrides this fact.

It also stays much much longer in the atmosphere than all the others.

Producing such a large amount of CO_2 and having it sit in the atmosphere is by far the biggest contribution to global warming, since it traps sunlight & does not let it escape.

ResultsPlus
Examiner Comments

This answer gained four marks. The candidate states that carbon dioxide is the biggest contributor and goes on to explain why in terms of being longer lasting and released in the highest amounts, even though it has a low GWP.

(ii) Evaluate the information in the table to identify which of these gases is likely to contribute most to global warming.

(5)

Carbon dioxide is one of the main contribute to global warming as it has 77% of all greenhouse gas emissions, it has the longest length of time in the atmosphere the increase of carbon dioxide produces a laye on the ozone atmosphere which blocks heat rays to leave into space, this heat is trapped causing temperatures to rise. Nitrous oxide is also a leade in the climate crisis as not only does it rise the temperatures due to the 270 GWP which is the highest out of the three gases but also when released into the air it combines with the water particles in the clouds so when it rains it produces acid rain killing aquatic animals in ~~that~~ lakes and oceans.

ResultsPlus
Examiner Comments

This answer gained just one mark. Unfortunately, the candidate states that carbon dioxide is one of the main contributors rather than the contributor. One mark is given for the idea that it lasts longest. The comment about the 77% of all greenhouse emission is simply quoting data and not giving a context. Nitrous oxide is listed as having the highest GWP but no further information is given.

(ii) Evaluate the information in the table to identify which of these gases is likely to contribute most to global warming.

(5)

Carbon dioxide is most likely to contribute to global warming as it stays ~~trapped~~ in the atmosphere for 1000 years, which is the longest out of the three, meaning it can trap heat for a longer period of time which contributes to global warming. It is also 77% of all greenhouse ges emmissions, so it has the largest volume out of the three. Nitrous oxide is also very likely to contribute to global warming because it has the highest global warming potential (GTWP). That means it absorbs the most heat for its mass, so it is the most efficient at heating up the Earth. However methane and carbon dioxide both have a much higher percentage of all greenhouse emissions. Carbon dioxide also has the lowest by far GTWP, so perhaps it isn't the most likely.

ResultsPlus
Examiner Comments

This answer gained five marks for:

- correctly identifying carbon dioxide.
- stating that carbon dioxide last the longest.
- stating that carbon dioxide is the highest emission.
- stating that nitrous oxide has high GWP but low emission.
- stating that methane has lower GWP and more release than nitrous oxide.

(ii) Evaluate the information in the table to identify which of these gases is likely to contribute most to global warming.

(5)

Carbon dioxide makes up the highest percentage of greenhouse gas emissions at 77%. However, it is much less potent than the other green house gases. It stays in the atmosphere for the longest.

Methane ~~is the fast most potent~~ greenhouse gas makes up ~~most the most~~ 16% of greenhouse gases in the atmosphere. The product of its GWP and percentage of green house gas emissions is the highest indicating that it is the biggest contributer to global warming even though it doesn't stay in the atmosphere for very long.

While nitrous oxide is the most potent, it makes up a very small percentage of ~~the~~ green house gas emissions. Therefore, its effect is minimal even though it stays in the atmosphere for a long time.

(Total for Question 8 = 8 marks)

Green house gases absorb heat energy and prevent it from escaping the atmosphere. This results in an increase in temperature. If a green house gas is more potent, it can absorb more heat energy and contribute more to global warming. If it makes up a higher percentage of green house gas emissions, it has a higher mass, and so it can contribute more to global warming. If it stays in the atmosphere for longer, it will absorb more heat.

ResultsPlus
Examiner Comments

This answer gained five marks for:

- identifying carbon dioxide as being highest emission.
- identifying carbon dioxide as having lower GWP (less potent).
- identifying carbon dioxide as lasting longest.
- stating that methane has higher GWP but lasts less time.
- stating that nitrous oxide has higher GWP (less potent) but only a little is released.

Question 9 (a)(i)

This question tested the candidates direct recall of the definition of the term transgenic. The definition for this term is given in the specification as: 'transgenic means the transfer of genetic material from one species to a different species'. Many candidates had clearly learnt the definition well and scored the mark. A significant number, however, referred to the movement of DNA from one organism to another rather than from different species. When giving definitions that are listed in the specification candidates should ensure that they are accurate.

9 Scientists have developed transgenic crop plants that are resistant to herbicides (weedkillers).

(a) (i) State what is meant by the term **transgenic**.

(1)

Transgenic is an organism that contains a gene from another organism/species.

ResultsPlus
Examiner Comments

This answer gained one mark for correctly stating that transgenic refers to organisms with genes from different species.

9 Scientists have developed transgenic crop plants that are resistant to herbicides (weedkillers).

(a) (i) State what is meant by the term **transgenic**.

(1)

has been genetically modified to have desired genes

ResultsPlus
Examiner Comments

This answer did not gain any credit. Despite referring to genes, there is no mention of the movement of them between species.

9 Scientists have developed transgenic crop plants that are resistant to herbicides (weedkillers).

(a) (i) State what is meant by the term **transgenic**.

(1)

Containing genes / alleles from another organism.

ResultsPlus
Examiner Comments

This answer gained no mark as although there is mention of genes moving between organisms, the answer needs to state the genes move between different species.

Question 9 (a)(ii)

Many candidates gained at least one mark for this question about the benefits of growing herbicide resistant crops. Strong answers stated that the herbicides would kill weeds but not the crops and this would reduce competition and increase the yield. Weaker answers tended to confuse the term herbicide with pesticide and suggested that the crops would kill pests. Only a few candidates suggested factors that the plants would be competing for with the weeds – it is good practice when discussing competition to name factors that are being competed for.

(ii) Suggest why growing herbicide-resistant crop plants is beneficial to farmers.

(2)

· Reduces crop death / failure, Therefore reduces costs

· Increases yield · Allows farmers to kill weeds without damaging their crop

· Increases profit

· Pest control potential

ResultsPlus
Examiner Comments

This good answer gained two marks. The candidate has stated that the weeds will be killed but crops are unharmed and gone on to say that the yield of crop will increase.

(ii) Suggest why growing herbicide-resistant crop plants is beneficial to farmers.

(2)

It allows the crops to spray herbicides at the crops to kill ~~weeds~~ ~~which~~ weeds ~~which~~ without killing or damaging the crops. This increases crop yield as it gets rid of weeds which compete with crops for nutrients, so nutrients grow faster and bigger as they have

ResultsPlus
Examiner Comments

This answer gained two marks for correctly stating that the crops would survive but the weeds would die and then explaining that this would increase the crop yield.

(ii) Suggest why growing herbicide-resistant crop plants is beneficial to farmers.

(2)

no need to use ~~pesticide~~ pesticides which is less time consuming and expensive, and doesnt damage the plants

ResultsPlus
Examiner Comments

This answer gained no marks and is a typical example of where a candidate has confused pest resistant crops with herbicide resistant crops.

Question 9 (b)(i)

Most candidates were able to identify non-resistant crops as having genotypes of RR or Rr. A few candidates misread the information in the question and gave the genotype as rr.

(i) Give the possible genotypes of Palmer amaranth plants that are not resistant to herbicides.

(1)

RR, Rr, rR rr RR, Rr, rR

ResultsPlus
Examiner Comments

This answer gained one mark for giving the correct possible genotypes.

(i) Give the possible genotypes of Palmer amaranth plants that are not resistant to herbicides.

(1)

RR Rr

ResultsPlus
Examiner Comments

This answer gained no marks as only one genotype is given.

Question 9 (b)(ii)-(iii)

For these two questions, candidates had to construct a genetic diagram, clearly labelling the phenotypes of the offspring and then determine the correct probability of producing resistant plants. Many excellent answers were seen that gained full marks for both questions and it is clear that centres are preparing candidates well for questions with genetic crosses. Common errors that candidates made included:

- not labelling the phenotypes of the offspring.
- selecting two heterozygous parents.
- placing two alleles in each gamete.

The letters that candidates were asked to use were R and r. Although candidates were not penalised for using different letters, it is important to use upper and lower case letters (eg A and a) rather than different letters (eg A and B). It is also good practice to use letters where the upper and lower case cannot be easily confused, for example H and h, rather than C and c.

(ii) A Palmer amaranth plant that is resistant to herbicides is crossed with a Palmer amaranth plant that is heterozygous for herbicide resistance.

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

(3)

	r	r
R	Rr	Rr
r	rr	rr

$\frac{2}{4}$

Parents

[redacted] : rr, Rr

Offspring : Rr, Rr, rr, rr

Rr = not herbicide resistant but carry the gene

rr = herbicide resistant

(iii) Give the probability of the cross in (b)(ii) producing a plant that is resistant to herbicide.

(1)

$\frac{2}{4}$ or 50%.

ResultsPlus
Examiner Comments

This answer gained full marks for both questions. The cross is set out well and the phenotypes described under the cross.

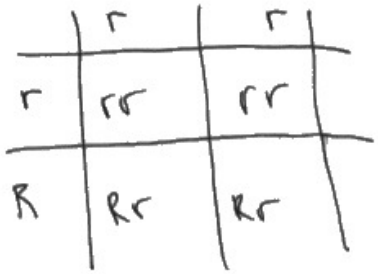
ResultsPlus
Examiner Tip

Don't forget to give phenotypes of the offspring and set out crosses neatly.

(ii) A Palmer amaranth plant that is resistant to herbicides is crossed with a Palmer amaranth plant that is heterozygous for herbicide resistance.

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

(3)



(iii) Give the probability of the cross in (b)(ii) producing a plant that is resistant to herbicide.

(1)

50 %

ResultsPlus
Examiner Comments

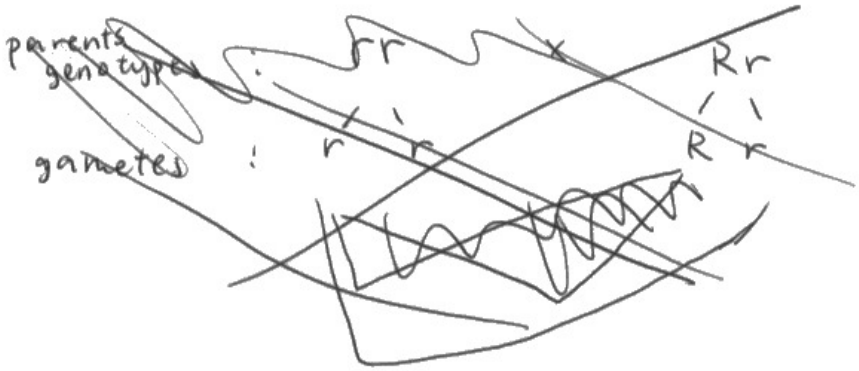
This answer gained two marks for the cross and one mark for the correct probability.

The cross is correct but the candidate has not given the phenotypes of the offspring.

(ii) A Palmer amaranth plant that is resistant to herbicides is crossed with a Palmer amaranth plant that is heterozygous for herbicide resistance.

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

(3)



parent genotypes : ~~RR~~Rr x rr

gametes : R r r r

offspring genotypes : Rr Rr rr rr

: 1 Rr : 1 rr

~~offspring phenotypes : 50% not resistant , 50% resistant~~

offspring phenotypes : 50% not resistant . 50% resistant.

(iii) Give the probability of the cross in (b)(ii) producing a plant that is resistant to herbicide.

(1)

$\frac{1}{2}$

ResultsPlus
Examiner Comments

This answer gained full marks. The cross is set out correctly and the phenotypes of the offspring given.

ResultsPlus
Examiner Tip

If you need to select letters for alleles, select ones that have clearly distinct upper and lower cases, eg Q and q **NOT** C and c.

Question 9 (b)(iv)

This question asked candidates to explain the process by which weeds can evolve resistance over time by natural selection. Many excellent answers were seen that gained full marks and it is clear that candidates and centres prepare carefully for questions about natural selection. Many candidates correctly stated that mutation would occur and that this would enable better survival, reproduction, and so pass on the alleles to the next generation. Candidates should be clear that it is the allele that is passed on rather than the characteristic or the trait. Candidates should also be clear about the increased reproduction of the organisms rather than simply saying that numbers increase.

(iv) Explain how Palmer amaranth plants have evolved to become resistant to herbicides in areas where herbicides are used frequently.

(4)

There was a mutation which made a plant resistant to herbicides, this favourable allele is passed onto offspring as the plants reproduce, this repeated for generations till all the Palmer amaranth plants became resistant to herbicides.

ResultsPlus
Examiner Comments

This answer gained three marks for correctly stating that mutations occurred and that the allele was passed on during reproduction.

(iv) Explain how Palmer amaranth plants have evolved to become resistant to herbicides in areas where herbicides are used frequently.

(4)

① Palmer amaranth plant mutated and became resistant to herbicides.
② they survive from herbicides.
③ they reproduce
④ passes the alleles to the next generation.

ResultsPlus
Examiner Comments

This answer gained all four marks for stating that the plants mutated, survived better, reproduced and then passed on the allele to the next generation.

(iv) Explain how Palmer amaranth plants have evolved to become resistant to herbicides in areas where herbicides are used frequently.

(4)

Mutation in plants create variations of resistant. Those plants with resistant to herbicide will servive from it and reproduce. Their gene of resistantce will more likely to passed on. Throughout generations, this gene with resistant become more commen.

ResultsPlus
Examiner Comments

This excellent answer gained all four marks for describing the reproduction, survival, passing on of genes and reproduction of the plants.

Question 9 (b)(v)

This very challenging question generated a wide range of answers. Candidates were asked to explain why if resistance is due to a recessive allele, no non-resistant weeds exist after a few generations but if resistance is dominant, some non-resistant genes do occur. Despite many candidates finding the question challenging, there were many outstanding answers. The stronger answers explained that if resistance is due to a dominant allele, non-resistant recessive alleles could be carried, and when two heterozygotes reproduce, some of the offspring would not be resistant.

(v) In plants such as Palmer amaranth, where the allele for herbicide resistance is recessive, no non-resistant weeds occur after five years of using herbicides.

In other plants, where the allele for herbicide-resistance is dominant, some non-resistant weeds occur after five years of using herbicides.

Explain this difference in the number of non-resistant weeds after five years of using herbicides.

(2)

Some genotypes of the resistant parents are heterozygous and still carry the recessive gene
if two heterozygous plants breed they make non resistant offspring

(Total for Question 9 = 14 marks)

however when the herbicide allele is recessive homozygous resistant offspring have genotypes have to be produced therefor no longer dominant is available.

ResultsPlus
Examiner Comments

This answer gained two marks for stating that the heterozygotes will carry the recessive allele and if two breed, some of the offspring will receive two recessive alleles.

(v) In plants such as Palmer amaranth, where the allele for herbicide resistance is recessive, no non-resistant weeds occur after five years of using herbicides.

In other plants, where the allele for herbicide-resistance is dominant, some non-resistant weeds occur after five years of using herbicides.

Explain this difference in the number of non-resistant weeds after five years of using herbicides.

(2)

for palmer it has to be homozygous resisive to be resistant so only recisive allels are passed on however in other plant it can be homozygous dominant or hetrozygous cuse can carrier resstive gener that pass on.

ResultsPlus
Examiner Comments

This answer gained two marks for stating that if recessive, only rr plants will survive and that if dominant, some heterozygous plants will survive that can pass on the recessive (non-resistant) allele.

(v) In plants such as Palmer amaranth, where the allele for herbicide resistance is recessive, no non-resistant weeds occur after five years of using herbicides.

In other plants, where the allele for herbicide-resistance is dominant, some non-resistant weeds occur after five years of using herbicides.

Explain this difference in the number of non-resistant weeds after five years of using herbicides.

(2)

~~As~~ if In places where allele for herbicide-resistance is domainent, the one parent might had carrier alleles and ~~only than after~~ the other parent was homozygous, where the (shown in 1st diagram) produce offspring like RR, Rr, RR, Rr on then selective breeding might have occured that two bred the two offsprings that had the carrier allele and produced homozygous recesive alleles that are resistant

2nd diagram

	R	r	r
R	RR	Rr	
r	Rr	rr	

1 diagram

	R	r
R	RR	Rr
R	RR	Rr

(Total for Question 9 = 14 marks)

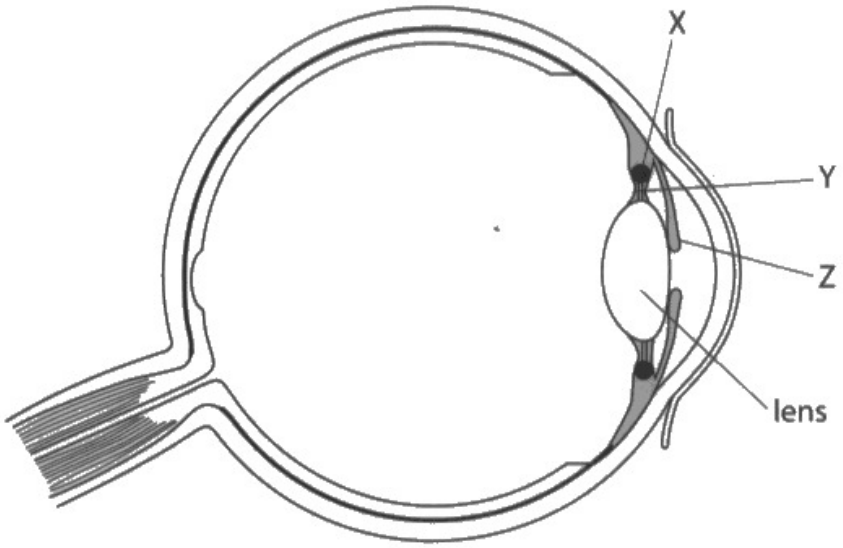
ResultsPlus
Examiner Comments

This excellent answer gained both marks for explaining that the plants may carry a recessive allele if resistance is dominant and then goes on to show a cross to illustrate how offspring could gain two recessive alleles.

Question 10 (a)(i)

This question required candidates to identify and name the iris on a diagram of the eye. Most candidates gained the mark, although a few labelled the iris as the pupil or the lens.

10 The diagram shows the structure of a human eye.



(a) (i) Give the name of structure Z.

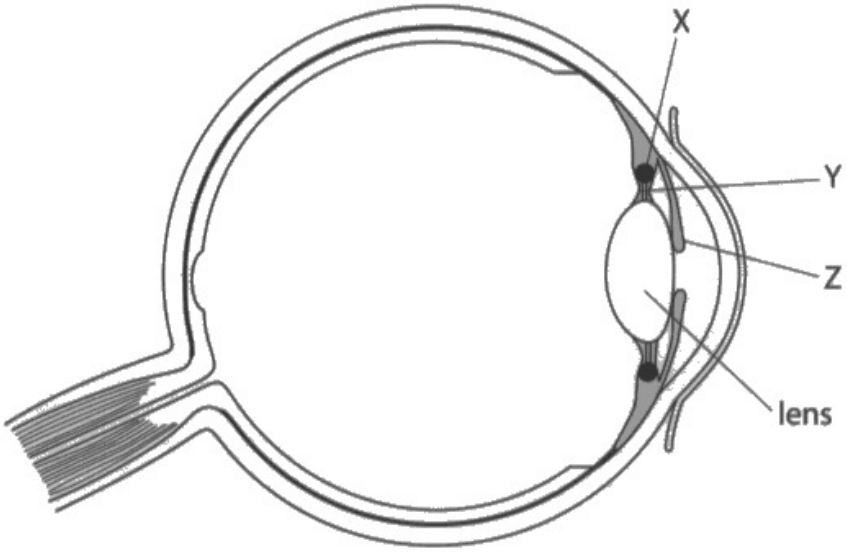
(1)

Iris

ResultsPlus
Examiner Comments

This is a correct answer that gained the mark.

10 The diagram shows the structure of a human eye.



(a) (i) Give the name of structure Z.

(1)

suspensory ligaments

ResultsPlus
Examiner Comments

This is an example of an incorrect answer where the candidate has confused the iris with the suspensory ligaments.

Question 10 (a)(ii)

In this question, candidates were asked to explain how two labelled structures (X and Y) are able to alter the shape of the lens when focusing on a nearby object. Many strong answers were seen that gained all three marks for explaining how the ciliary muscles contract, the suspensory ligaments go slack, and the lens thickens. A few candidates incorrectly stated that the muscles relax, and others referred to the contraction of the suspensory ligaments.

(ii) Describe how structures X and Y control the shape of a lens when focusing on a near object.

(3)

When looking at a near object, the ciliary muscles contr-act and the suspensory ligaments slacken, leading to the lens becoming thicker to allow light to refract more to see the image clearly.

ResultsPlus
Examiner Comments

This excellent answer gained three marks and actually has all four mark points. The candidates clearly states that the ciliary muscles contract, the suspensory ligaments slacken, the lens thickens and the lens refracts the light more.

ResultsPlus
Examiner Tip

When referring to suspensory ligaments, state that they slacken rather than relax. When referring to the lens, don't say it gets bigger, say that it gets thicker or more convex.

(ii) Describe how structures X and Y control the shape of a lens when focusing on a near object.

(3)

- when an object is nearer the light rays are diverging
- the focal length
- the ciliary muscles (structure Y) contract
- the suspensory ligaments (structure X) loosen
- this makes the shape of the lens thicker and more convex

ResultsPlus
Examiner Comments

This answer gained all three marks for stating that the muscles contract, the ligaments loosen and the lens becomes more convex.

(ii) Describe how structures X and Y control the shape of a lens when focusing on a near object.

(3)

Step Suspensory ligament relaxes
Ciliary muscle Contract
Lens is pulled thicker

ResultsPlus
Examiner Comments

This answer gained two marks for the muscles contracting and the lens getting thicker. The ligaments relaxing was not given a mark as relaxing implies that they are muscular tissues.

Question 10 (b)(i)

This question presented candidates with information about cataracts in the lens. This first part of the question asked the candidates to suggest why cataracts would affect vision. Although cataracts are not listed in the specification, information about them was given in the question and the question was testing candidates' understanding of how the eye functions. Many candidates gave excellent answers that gained both marks. Strong answers stated that less light would pass through the lens (or that refraction was affected) to the retina. Only a few candidates referred to impulses passing along the optic nerve – signals was not accepted as an alternative to impulses.

(b) A cataract occurs when the lens becomes cloudy.

Severe cataracts are the main cause of blindness around the world.

(i) Explain why people with cataracts are unable to see clearly.

(2)

- light is not able to be refracted by lens well, blurred image reached by rods in the retina, optic nerve signals to brain don't show clear image
- less light can pass through the lens, to the retina, optic nerve sends under signals to brain

ResultsPlus
Examiner Comments

This answer gained both marks for correctly stating that less light passes through the lens onto the retina.

(b) A cataract occurs when the lens becomes cloudy.

Severe cataracts are the main cause of blindness around the world.

(i) Explain why people with cataracts are unable to see clearly.

(2)

- The lens become cloudy, ~~not able to refle refr~~ allowing the light ~~to~~ refract pass through ~~and into~~ ~~accurately~~ completely and into the retina
- The retina does not transmit the correct signal to the brain
- Hence unable to see clearly

ResultsPlus
Examiner Comments

This answer gained two marks for stating that refraction is affected as light passes through the lens onto the retina. The candidate would not have gained a mark for 'signals to the brain' although they have already gained two marks.

(b) A cataract occurs when the lens becomes cloudy.

Severe cataracts are the main cause of blindness around the world.

(i) Explain why people with cataracts are unable to see clearly.

(2)

- When the lens is cloudy, light is unable not refracted onto the retina.
- So cone and rod cells are unable to detect colour and light and produce electrical impulses to the brain

ResultsPlus
Examiner Comments

This excellent answer has all three mark points present. The candidate refers to altered refraction onto the retina and explains that rod and cone cells are less able to send impulses to the brain.

Question 10 (b)(ii)

This final question of the paper presented candidates with data showing the effect of increased exposure to sunlight on the risk of developing cataracts. The examiners were impressed with the quality of answers seen, with most candidates gaining at least one mark and many gaining all four. Many candidates recognised that there was a simple trend showing that increased exposure led to increased numbers of cataracts. Many candidates also recognised that the group sizes were different, so validity was an issue. Commendably, a significant number of candidates determined the percentage of people with cataracts at each exposure time and recognised that there was only a real increase after 11 hours. The examiners were impressed with how many candidates used their calculated percentages to support their answers. Strong answers also referred to other factors that were not accounted for, such as clothing, diet and genetics and the fact that the data was from only one country. The quality of answers seen shows that candidates and centres are preparing very well for these longer, data analysis questions and they should be commended for their hard work.

Comment on the results of the investigation.

(4)

~~As daily exposure to sunlight increases, risk of developing cataracts increase.~~ Cataract risk increases ~~greatly~~ when exposure time increases to above 11 hours. When daily exposure to sunlight is more than 11 hours, the longer the time of exposure, the higher the rate of developing cataracts. Under normal sun light exposure the rate of developing cataracts is around 1.5% to 2%. The experiment did not control the same number of people in each group, and not enough information about the age of the participants are disclosed. The investigation lacks reliability. People should wear suglasses to prevent risk of developing cataracts when their eyes are exposed to sun light excessively, and they shold avoid overusing eyes.

ResultsPlus
Examiner Comments

This excellent answer gained all four marks. The candidate clearly states that cataract numbers increase and has used calculated percentages in their answer. They also discuss the reliability of the investigation and other factors that may influence the development of cataracts.

Comment on the results of the investigation.

(4)

The investigation is long, so results are more reliable.
UV light do ~~cause~~ influence or increase the chance of getting cataracts ~~be~~ as the chance does gradually increase, with 6.5%. However, the increase is not significant enough to conclude that it has an impact as it's only 4% higher.
The investigation included many people, reliable.
The investigation experimented on a range of scenarios, from 7 - 12 hour, making it reliable
However, all the participants are from south asian, can be unreliable and not representative.

(Total for Question 10 = 10 marks)

the participants are only one ~~by~~ type of people, agriculture workers.

TOTAL FOR PAPER = 110 MARKS

ResultsPlus
Examiner Comments

This good answer gained three marks for identifying the increase, using a percentage calculation and discussing the reliability of the data.

Comment on the results of the investigation.

(4)

- The longer you spend to the exposure to sunlight which is a source of Ultraviolet light, the more people and higher percentage of chance for you to develop cataracts.
- Increase percentage from only 2% chance in 7 hours of sunlight to 4% chance to develop cataracts in 12 hours exposed to sunlight.
- Even people with higher group of people in less hours gets less effected than lower number of people in a group but long hours of exposure to sunlight.

ResultsPlus
Examiner Comments

This answer gained two marks for recognising the increase and using calculated percentages in their answer.

Comment on the results of the investigation.

(4)

The result shown that as the hours of exposure to sun light increases the number of people developed cataracts also increases. However, the number of people in a group were not controlled, ~~should~~ should kept the same, the age of people were not mentioned, the life style of sample were not clearly showned. The ~~#~~ possibility of inheritance of cataracts were not mentioned. the sample size could be larger, the experiments not repeated to calculate mean value.

ResultsPlus
Examiner Comments

This answer gained three marks for recognising the increase, noting that group sizes were different and suggesting other factors that would affect the data.

Comment on the results of the investigation.

(4)

- Large sample size so, study is valid.
- UV light in sunlight is energetic enough to break bonds so can be viable cause of cataracts, as protein / DNA may get damaged by it.
- Increase in daily sunlight exposure does increase no. of people who develop cataracts.
- However, inconsistent no. of people in group makes it seem that higher % develop cataracts. Percentage is >2% in 8 hours and 10 hours, so sunlight may not be main cause.
- Could be genetic.
- No information of family history, age, and health.

ResultsPlus
Examiner Comments

This answer gained four marks for recognising the increase, stating that group sizes vary, discussing reliability and noting that other factors, such as age and genetics, would influence the results.

Comment on the results of the investigation.

(4)

from 7-10 hours of exposure to sunlight daily, the percentage of people who develop cataracts are quite similar. (around 1.55% - 2%)

however, 11-12 hours of exposure to sunlight, showed an increase in workers developing cataracts

- one south Asian country cannot represent the other countries
- lack of information : the worker's age, sex
  we also don't know if workers get additional sunlight apart from work.

ResultsPlus
Examiner Comments

This excellent answer gained all four marks. The candidate clearly states that there is little increase up to 11 hours, calculates and uses percentages, notes the increase at 11 hours and discusses both reliability and other factors that affect the cataract development.

Paper Summary

Based on their performance on this paper, candidates should:

- Be fully familiar with all the different command words.
- Be familiar with all the mathematical skills listed in the specification.
- Explore all the data thoroughly in the longer, data analysis questions.
- Use full, detailed scientific terminology.
- Be familiar and confident with practical terminology such as reliability, accuracy and precision.

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