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Examiners' Report
June 2018

GCE Biology B 9BI0 01

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Introduction

This paper assesses any of the AS topics (topics 1 - 4) and the A2 topics 5 - 7. The mark allocation is 50% for topics 1 - 4 and 50% for topics 5 -7. There has to be 10% of these marks assessing level two mathematics.

This was the second paper of the new specification and there was some improvement in the performance of candidates, particularly at the top end of the ability range. Candidates have a better understanding of some of the new command words and were more prepared for the demands of the levels-based six-mark questions. The multiple-choice questions saw a range of responses and discriminated well. All of our mark points were seen.

Question 1 (b)

Candidates could take two approaches to describing the effect of snake venom on the time taken to clot blood; they could look at the data vertically and describe the effect of increasing mass and they could make a horizontal comparison with Factor Xa. We saw both approaches but few candidates actually did both.

Describe the effect of snake venom on the time taken for the blood to clot.

(2)

As the mass added of snake venom increases, the time taken for blood to clot decreases between 0.020ng and 0.040ng the time taken for the blood to clot is not ~~s~~significantly different- as there is only 1 second difference

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Examiner Comments

This candidate scored mark points 1 and 3 by describing the effect of increasing the mass of snake venom.

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Examiner Tip

When describing data, describe the overall effect and then any significant change or lack of change, referencing values for the independent variable.

Question 1 (c)

This question was supposed to be a straightforward question at the start of the paper, worth one mark. A number of candidates gave details of the blood clotting process without actually stating its role. Other candidates tried to state the role but repeated too much of the stem.

snake venom is effective in small doses (0 0 0 2 ms)

(c) State the role of platelets in the blood clotting process.

(1)

Platelets collect at a wound, in order to clot, to stop the body from loosing blood and to keep harmful bacteria out of the wound. by creating a barrier over the wound in the form of a scab.

ResultsPlus
Examiner Comments

This is an example of one way the mark could be awarded.

ResultsPlus
Examiner Tip

Do not repeat the stem of the question in your answer; you need to add to the information given.

Question 2 (b)

All our mark points were seen for this question but very few candidates gave us all three in their response.

(b) Describe how this precursor molecule is modified to produce a tRNA molecule specific for the amino acid proline.

(3)

The 5' end is shortened - nucleotides are removed and the 3' end is removed and then replaced with the nucleotides containing bases ACC. The shaded part The bottom of the bottom is remove and the U base nucleotide forms a phosphodiester bond to the end.

ResultsPlus
Examiner Comments

This response illustrates all three of our mark points.

ResultsPlus
Examiner Tip

Read the stem of the question very carefully as it will give you clues to what is expected from you in your answers. At the very beginning of the question we say "Modification includes splicing, trimming and attachment of new nucleotides." This is your clue to as to what to write in answer to this question.

Question 3 (a) (i)

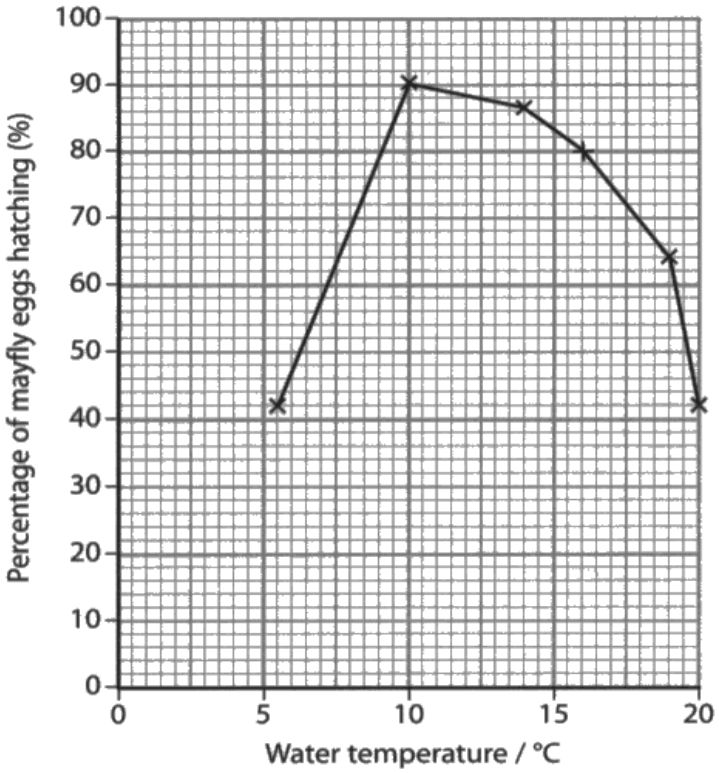
Many candidates answered this correctly but predictably some candidates do not appreciate that only the first word of the binomial name is the genus.

Question 3 (b)

A range of responses was seen to this question with most candidates identifying that the temperature is affecting the enzymes involved in the development or hatching of the mayfly nymphs.

(b) Mayflies lay their eggs in water.

The graph shows the effect of water temperature on the percentage of mayfly eggs that hatch.



Explain the effect of temperature on the percentage of mayfly eggs that hatch.

(4)

Below 5.5°C no mayfly eggs hatch this may be because they don't lay them as not warm enough for enzymes to produce eggs. From 5.5 to 10°C there is a rapid increase in number of eggs that hatch by 48% this is because enzymes work best at 10°C as more kinetic energy to speed up metabolic reactions and cause the eggs to hatch, the increase temperature may also break the bonds holding the egg walls so they break. After 10°C there is a gradual decrease in eggs that hatch may be because it is too hot so will dry out or because enzymes are denaturing.

ResultsPlus
Examiner Comments

This response was awarded mark points 2, 3, 1 and 4.

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Examiner Tip

When describing the effect of higher temperatures on enzyme activity, be careful not to state that the enzymes *start* to denature.

Question 3 (c)

There were a number of reasons for candidates not scoring well on this question, which included writing two descriptions instead of direct comparisons, making comments about non-structural aspects of gas exchange and not including similarities and differences.

(c) Mayfly eggs hatch into immature insects called nymphs. The nymphs live in the water and develop to form adult mayflies.

The photograph shows a mayfly nymph.



- counter current mech
- spiracles

Compare and contrast the structure of the gas exchange system of the mayfly nymph with the adult mayfly.

(3)

compare → (Both take in O_2 and release CO_2)

↳ Both maximise surface area for gas exchange by having large SA (e.g gills in nymphs, and lots of spiracles in ~~insects~~ adult mayfly)

Contrast

↳ nymphs use a counter current mechanism, using their feathering gills to increase gas exchange. (water to blood)

↳ whereas Adult mayflies use spiracles for gas exchange and use pressure to force air in out out. (air to blood)

↳ nymphs use gills, mayflies use spiracles

(Total for Question 3 = 9 marks)

water



Insect

Mayfly

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Examiner Comments

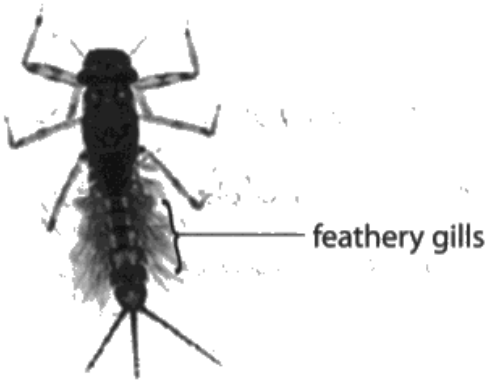
This candidate had clearly been taught how to approach a 'compare and contrast' question. They were awarded mark points 1 and 3.

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Examiner Tip

You must give both similarities and differences for a 'compare and contrast' question if you want access to full marks.

(c) Mayfly eggs hatch into immature insects called nymphs. The nymphs live in the water and develop to form adult mayflies.

The photograph shows a mayfly nymph.



Compare and contrast the structure of the gas exchange system of the mayfly nymph with the adult mayfly.

(3)

Nymphs have feathery gills used to obtain oxygen by diffusion from the water. Since they are small animals, the oxygen can directly diffuse from the gills to the cells through to muscles, organs and blood. ~~Adult mayflies~~ An adult mayfly has a system made from spiracles (the site of O_2 intake) tracheae, (large tubes carrying O_2 to the body) and tracheoles (smaller pipes where oxygen diffuses to cells. Due to the simple cell structure, all oxygen can diffuse easily due to a large ~~ratio~~ surface area to volume ratio, and small distance

(Total for Question 3 = 9 marks)

ResultsPlus
Examiner Comments

This candidate has written two descriptions which is not acceptable for this command.

ResultsPlus
Examiner Tip

When you see the command 'compare and contrast' you must not write two separate descriptions. Write a separate sentence for each comparison making sure that you describe what it is like for both objects. Something as simple as '*nymphs have gills and adults have spiracles*' would get you a mark as in one sentence you have given the gas exchange surface for each mayfly stage.

Question 4 (a)

Many candidates described the structure of haemoglobin, even though it is not mentioned anywhere in the question. A number of candidates do not really understand the role of the tertiary structure in determining the globular nature of a protein; there were lots of descriptions of quaternary structure which was not awarded.

4 Mitochondria can be extracted from liver cells.

In order to monitor the purification of a sample of mitochondria, a protein concentration : enzyme activity ratio can be determined.

(a) Describe the structure of a globular protein.

(2)

3D

globular protein has a 3D tertiary structure held together by strong hydrogen, disulfide bonds between R groups.

ResultsPlus
Examiner Comments

This response illustrates our first two points on the mark scheme.

4 Mitochondria can be extracted from liver cells.

In order to monitor the purification of a sample of mitochondria, a protein concentration : enzyme activity ratio can be determined.

(a) Describe the structure of a globular protein.

(2)

a globular proteins are folded in a tertiary structure form where they have hydrophylic amino acids on the outside. It three dimensional (3D).

ResultsPlus
Examiner Comments

This response illustrates our first and third point; we were very pleased to see a number of candidates making this third point.

Question 4 (b) (ii)

Some candidates gave very accurate and detailed descriptions of the Krebs cycle; however, this question concerned its role. It was clear that candidates do not really appreciate the role of the Krebs cycle. Many candidates did not link the electron transport chain with generating ATP from the reduced coenzymes.

(ii) Explain the role of the Krebs cycle.

(4)

In the krebs cycle acetyl CoA from the link reaction binds to oxaloacetate to form citrate (CoA is removed). This is then decarboxylated twice and oxidised by 2x NAD^+ to form a 4 carbon molecule. This 4 carbon molecule is then oxidised further by FAD^+ and NAD^+ so it can be converted back to oxaloacetate. This yields ATP. Overall the roles of the cycle is to generate reduced coenzymes which can be used to generate ATP in the electron transport chain.

ResultsPlus
Examiner Comments

This was one of the few examples where a candidate was trying to answer the question and understood the significance of the electron transport chain.

Question 4 (c) (i)

This question did not cause problems to the candidates who took care in reading the value from the graph.

(i) This sample of mitochondria had an absorbance of 0.28 when the protein concentration was measured.

Determine the protein concentration of this sample of mitochondria.

(1)

Answer 0·57 mg cm^{-3}

ResultsPlus
Examiner Comments

A correct answer.

ResultsPlus
Examiner Tip

Even though reading a value from a graph may seem straightforward, do not rush it as exact values not close ones are required.

Question 4 (c) (ii)

This was a very low scoring question. Candidates struggled with calculating a rate from a graph and at working out a ratio. There has to be 10% level two maths in one of these papers, so candidates need to be able to do the types of calculations that are listed in appendix 6 in the specification.

(i) This sample of mitochondria had an absorbance of 0.28 when the protein concentration was measured.

Determine the protein concentration of this sample of mitochondria.

(1)

Answer 0.56 mg cm^{-3}

(ii) Determine the initial rate of enzyme activity to obtain the protein : enzyme activity ratio for this sample of mitochondria.

(2)

$\frac{0.19 - 0.15}{15} = 0.00267$

0.56 : 0.00267

210 : 1

Ratio 210 : 1

ResultsPlus
Examiner Comments

Consequential error from part (i) in the calculation for part (ii) was allowed. This candidate did not read the value from the graph accurately enough in part (i) but was able to calculate a correct ratio using it.

ResultsPlus
Examiner Tip

Look at the required maths skills listed in appendix 6 of the specification and make sure that you can carry them out.

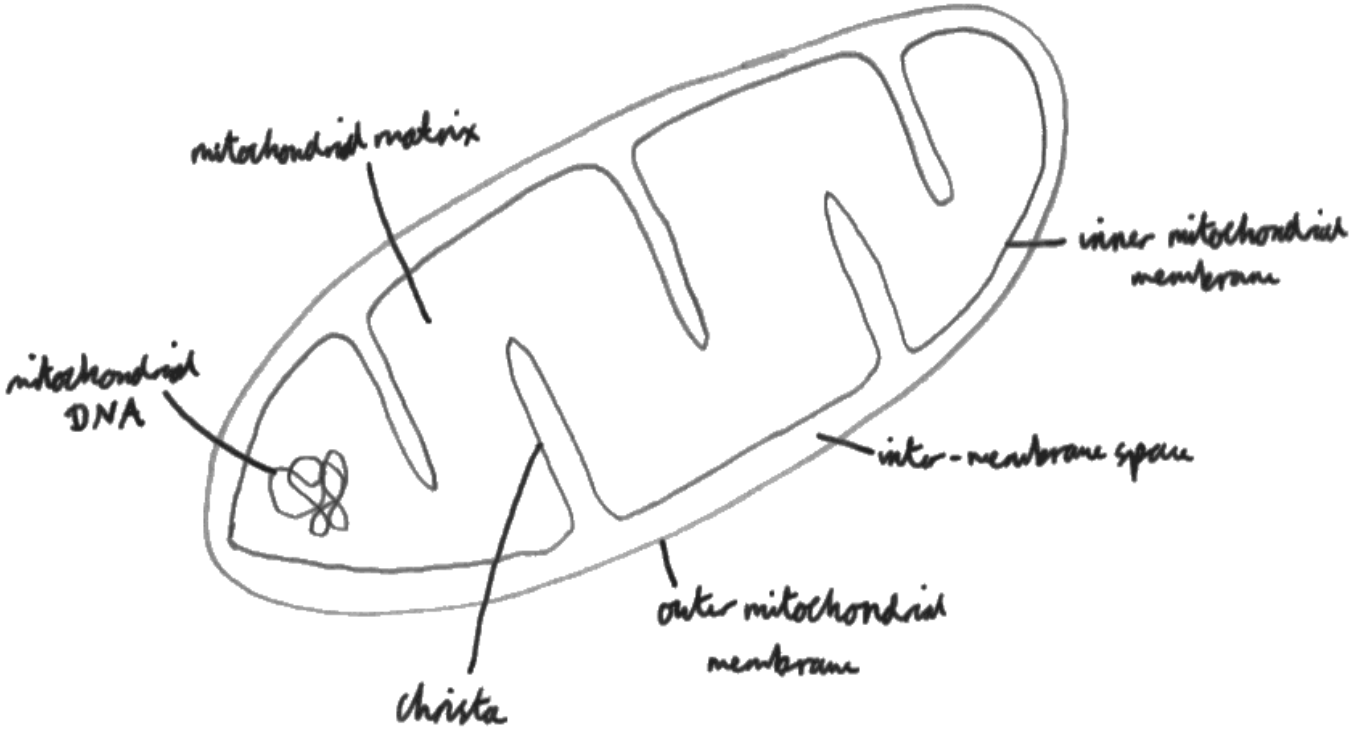
Question 5 (a)

A whole range of diagrams of a mitochondrion were produced.

5 Leigh syndrome is a genetic disorder inherited from the mother. The mother carries genes for the disorder in her mitochondrial DNA.

(a) Draw and label a mitochondrion.

(4)

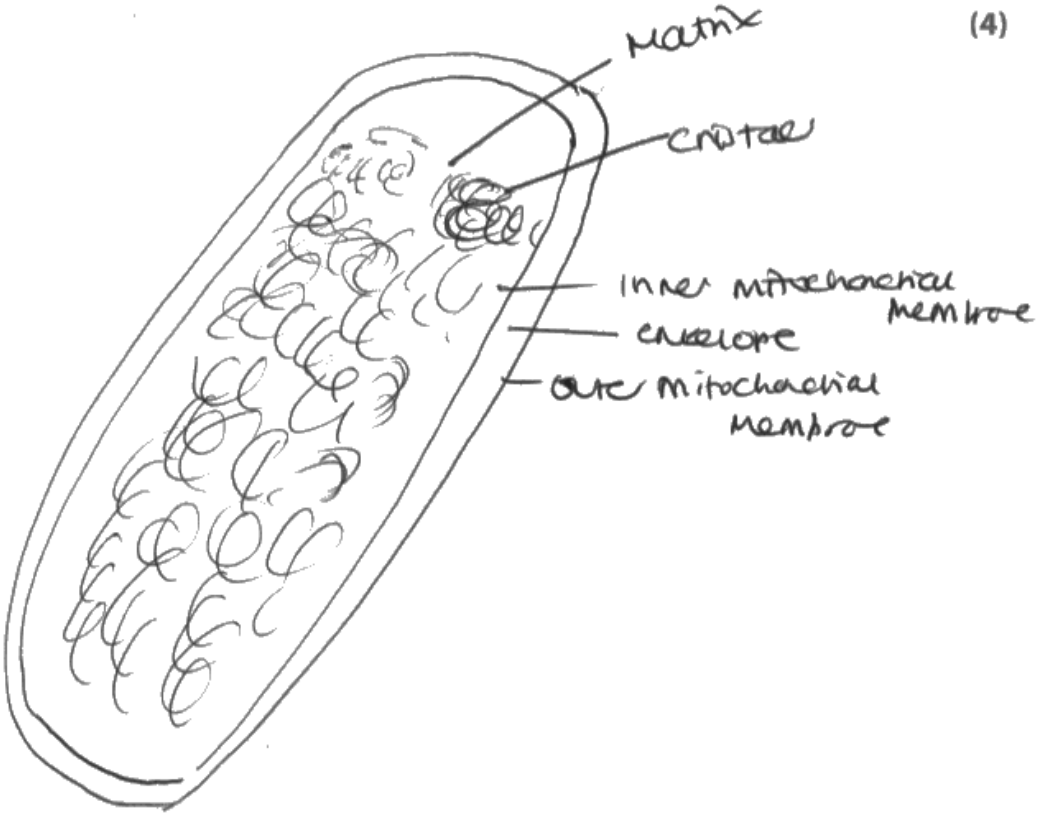


ResultsPlus
Examiner Comments

Some diagrams were very detailed and scored all four marks.

5 Leigh syndrome is a genetic disorder inherited from the mother. The mother carries genes for the disorder in her mitochondrial DNA.

(a) Draw and label a mitochondrion. **(4)**



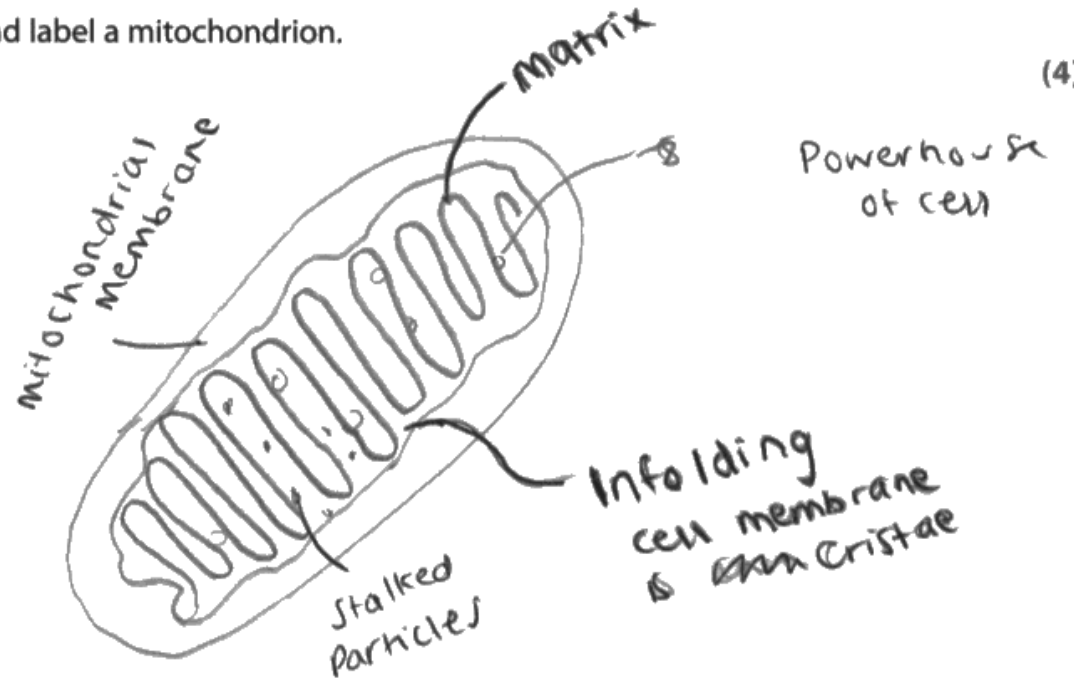
ResultsPlus
Examiner Comments

Others were not so detailed but we could award a couple of marks.

5 Leigh syndrome is a genetic disorder inherited from the mother. The mother carries genes for the disorder in her mitochondrial DNA.

(a) Draw and label a mitochondrion.

(4)



ResultsPlus
Examiner Comments

Others were so poor that we could not find anything to award.

ResultsPlus
Examiner Tip

Be prepared to draw and label cells and cell structures. The diagrams need to be accurately drawn and correctly labelled. Make sure that the end of the label line touches the structure you are actually labelling.

Question 5 (b) (ii)

This question was asking about the significance of DNA replication and mitosis, but candidates saw the terms 'zygote' and 'blastocyst' and wrote about differentiation and gene expression instead, which was incorrect.

(ii) Explain the importance of DNA replication during the development of this zygote into a blastocyst.

(3)

Specifically cleavage

the zygote will divide by the process of mitosis to ensure

and genetically identical to zygote,

are the daughter cells produced are diploid, therefore they will have

chromosomes and

are the gene necessary to produce different cell types where the

embryo

develop and the cell can differentiate into all possible body cell

types except placental because they are pluripotent. This can only occur

if all the DNA within the diploid zygote is transferred to

every daughter cell.



Although this candidate started to write about stem cells at the end, they did gain the first three of our mark points at the beginning of their response.



Do not word-spot and assume what you are supposed to be writing about. Read the whole of the question very carefully, both before and after you answer it.

(ii) Explain the importance of DNA replication during the development of this zygote into a blastocyst.

(3)

~~It is important that in DNA replication each cell mitoses to give the full number of chromosomes to each cell and that no chromosome non-disjunction occurs.~~ Cell must DNA replication is important to produce genetically identical cells during mitosis. It is important that the DNA replicates correctly to ensure each cell has the full 46 chromosomes and no chrom a more or less. It is important that the mitochondrial DNA that is healthy (from donor) is replicated so that the blastocyst cells have healthy mitochondria for respiration.

(Total for Question 5 = 8 marks)

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Examiner Comments

This candidate was awarded three marks, points 2, 3 and 4. Mark point 1 could not be awarded as there was no indication that the zygote was dividing by mitosis.

ResultsPlus
Examiner Tip

Make sure that your answer relates to the context of the question. Most questions on this new specification will be set in a context which you have to relate your answer to if you want to score highly.

Question 6 (a)

This question should have been answered correctly as this was also part of the old specification and therefore standard.

6 During the development of active immunity, macrophages present antigens to T helper cells.

(a) Describe how macrophages present antigens to T helper cells.

(2)

Macrophages engulf pathogens by endocytosis creating extensions of the cytoplasm. The macrophages then digest the pathogen, however on exocytosis of the products the antigens are attached on their MHC proteins. The T-helper cells with the correct receptor complementary attach to the antigen bind to the antigen on the macrophage and become activated.

ResultsPlus
Examiner Comments

Both points were made by this candidate, although it would have been good to see the T cell receptor named.

6 During the development of active immunity, macrophages present antigens to T helper cells.

(a) Describe how macrophages present antigens to T helper cells.

(2)

macrophages bind engulf antigen and bind antigen to its own major histocompability complex (MHC) and its presented on the cell surface membrane of macrophage so T helper cells can bind recognise and bind to it.

ResultsPlus
Examiner Comments

This was more typical of the responses that we saw where candidates did not demonstrate that they knew T cell receptors had to bind to the antigen-MHC complex on the macrophage. A number of candidates went into extensive descriptions of antigen processing.

ResultsPlus
Examiner Tip

Try to identify exactly what the question is asking of you. Avoid writing everything you know about any related topic as this will use up precious time that you do not have.

Question 6 (b) (i)

This question really helped to identify the grade A candidates as only the more able candidates were able to answer this question correctly. The stem of the question had to be read carefully to pick out the fact that mitomycin forms cross links between the DNA strands. Candidates should be familiar with hydrogen bonds forming cross links between molecules such as cellulose and collagen.

(b) In an investigation into clonal selection, macrophages and T cells were isolated from two strains of guinea pig, strain 2 and strain 13.

The macrophages from each strain of guinea pig were exposed to an antigen and treated with mitomycin.

Mitomycin forms cross links between complementary strands of DNA.

These macrophages were then cultured with T cells from each of the strains of guinea pig for 72 hours.

Radioactive thymidine was included in the culture. This molecule will become incorporated into DNA during DNA replication instead of thymine.

The table shows the results of this investigation.

Source of macrophages	Level of radioactive thymidine incorporated into T cells / a.u.	
	T cells from strain 2 guinea pigs	T cells from strain 13 guinea pigs
strain 2	180	13
strain 13	17	59

(i) Explain why the macrophages were treated with mitomycin.

(3)

To inhibit ~~prevent~~ DNA replication and therefore prevent mitosis of macrophages from occurring. Cross links will not allow DNA to unwind. This is so that the number of antigen presenting macrophages in both cultures remains constant and therefore does not effect ~~levels of~~ results. Ensuring there is only one variable. Also ensures only T cells are marked with radioactive thymine so when are carried out macroph

ResultsPlus
Examiner Comments

This candidate has clearly identified the appropriate information in the stem of the question as it has been underlined. Full marks were awarded.

ResultsPlus
Examiner Tip

You must read all the information in the question. Nothing is included that is not going to be needed to answer the question.

(b) In an investigation into clonal selection, macrophages and T cells were isolated from two strains of guinea pig, strain 2 and strain 13.

The macrophages from each strain of guinea pig were exposed to an antigen and treated with mitomycin.

Mitomycin forms cross links between complementary strands of DNA.

These macrophages were then cultured with T cells from each of the strains of guinea pig for 72 hours.

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(i) Explain why the macrophages were treated with mitomycin.

(3)

So that cross links would form between complimentary strands of DNA to prevent the macrophages from replicating by stopping DNA helicase from being able to unzip the DNA. This meant that the radioactive thymidine would only be used in T cells so the level of radioactivity accurately shows how much radioactive Thymidine has been used in the T cells.

ResultsPlus
Examiner Comments

Another example where the candidate has selected the appropriate information from the stem of the question and used it to score three marks.



Try underlining key information as you read through a question.

Question 6 (b) (ii)

Many candidates stated that the thymidine binds to adenine, but few thought the question through enough to mention the phosphodiester bonds actually joining the nucleotide into the DNA strand.

(ii) Explain how radioactive thymidine becomes incorporated into the DNA.

(2)

- During semi-conservative DNA replication thymidine forms hydrogen bonds with adenine (helped by DNA polymerase).
- DNA ligase forms the sugar phosphate backbone of the new DNA strand containing thymidine.

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Examiner Comments

Both mark points given in this response.

ResultsPlus
Examiner Tip

Consider if you have answered the question fully enough and if you have made at least as many points as there are marks allocated to the question.

Question 6 (b) (iii)

This question proved very challenging to the candidates but did discriminate well between the ability range of candidates.

(iii) Analyse the data to explain the results of this investigation.

(4)

The highest level of radioactive Thymine incorporated into T cells occured with strain 2 macrophages mixed with strain 2 T cells (180 T cells). ~~the~~ This means the higher rate of mitosis occured in this mixture. Strain 13 macrophages with strain 13 T cells showed 89 T cells with radioactive thymine which was 3x less than the strain 2 mixture (60) hower the second highest rate of mitosis. When opposite strain were mixed, very low rates of mitosis were shown (13 + 17). T cells and macrophages must be from same strain so T cell can have complementary receptor shape to macrophage so it can bind to MHC protein and initiate mitosis, therefore mixing strain was not effective. Strain 2 had a more effective response to antigen possibly due to previous exposure.

(Total for Question 6 = 11 marks)

ResultsPlus
Examiner Comments

This candidate looked carefully at the data and used the clues in the question to write a good response that was awarded mark points 1, 2 and 3.

ResultsPlus
Examiner Tip

Use the information given in the stem of the question and the questions asked at the beginning to identify what aspect of the specification is being assessed. Part (a) asked about antigen presentation to prompt your thinking about this and the first two parts of (b) were trying to get you to think about DNA replication and cell division.

(iii) Analyse the data to explain the results of this investigation.

(4)

the T cells from strain 2 guinea pigs with strain 2 macrophages had most radioactive thymine present because macrophages had guinea pigs self antigens so activated T helper cells to form clones + replicate by mitosis as could bind to macrophage which were antigen presenting cells. the strain 13 guinea pig with strain 2 macrophages had least radioactive thymine as macrophages had non-self antigens so couldn't bind to it to activate T helper cells, treated it as a foreign body so less T helper cell activation so less T helper cell clones so less new thymine bases. thelper cells cloned to activate B cells to produce antibodies to kill antigens.

(Total for Question 6 = 11 marks)

ResultsPlus
Examiner Comments

Another decent response gaining mark points 1, 4 and 3.

Question 7 (a) (ii)

This question should have been straightforward but did not score well for three main reasons. Firstly, a number of candidates wrote two separate descriptions of xylem and phloem instead of describing the differences. Secondly, the level of detail was barely above GCSE, for example 'xylem is dead and phloem is living'. Thirdly, structural differences were not given.

(ii) Describe the differences between the structure of xylem and that of phloem.

(3)

Phloem is a living tissue, while xylem is a dead tissue. This means the cells in the xylem are now dead, while the phloem tube members are still alive, supported by their companion cells, which xylem cells do not have. Xylem cells have no end cell walls to allow water to move freely, while phloem tube members have sieve plates, which play an active role in phloem transport. Finally, the xylem is lignified, meaning no water can leave, while the phloem is not lignified.

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Examiner Comments

Three clear differences given - points 4, 2 and 1.

(ii) Describe the differences between the structure of xylem and that of phloem.

(3)

Xylem vessels are formed by dead xylem cells with lignified walls. The ends of the cells line up forming long tubes and the ends break down so the tubes are continuous. Whole phloem vessels, however, are formed of the living cells but most metabolic reactions are controlled by companion cells to which they are connected by plasmodesmata. They also contain sieve ~~tube~~ ele plates between phloem cells.

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Examiner Comments

This response is simply two descriptions of xylem and phloem.

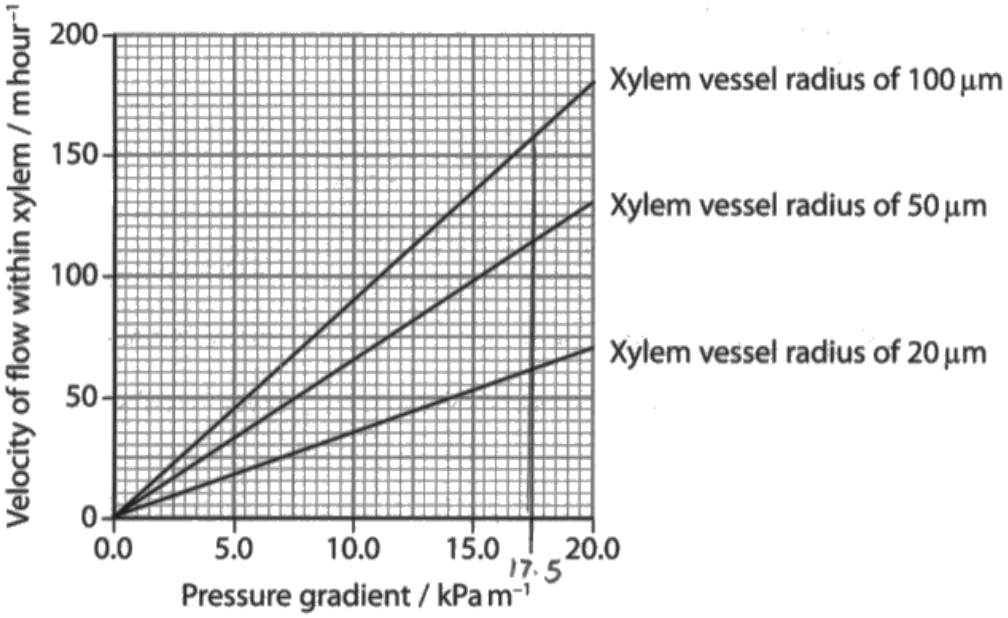
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Examiner Tip

Differences between two things should be given as pairs in one sentence, in the same way as similarities and differences are given in a compare and contrast question.

Question 7 (b) (i)

Describing this graph caused most candidates very little problem.

(b) The graph shows the effect of pressure gradient on the velocity of flow within three xylem vessels.



(i) Describe the effect of pressure gradient and radius on the velocity of flow within the xylem vessels.

(2)

- The lower the pressure gradient, the lower the velocity of flow, concluded from results on graph.
- The narrower the radius and thus diameter of the xylem vessel, the lower the velocity of flow through the xylem.

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Examiner Comments

A typical response scoring two marks.

Question 7 (b) (ii)

Reading two values from the graph was not a problem for those candidates who took a bit of care. Any calculation involving a percentage causes problems, and this was no exception.

(ii) Calculate the percentage increase in the velocity of water flowing through a xylem vessel of radius 20 µm and a xylem vessel of radius 100 µm, at a pressure gradient of 17.5 kPa m^{-1}.

(2)

$\frac{157 - 61}{61} \times 100 = 157\%$.

Answer 157%.

ResultsPlus
Examiner Comments

A clearly laid-out calculation using values that had been carefully read from the graph.

(ii) Calculate the percentage increase in the velocity of water flowing through a xylem vessel of radius 20 µm and a xylem vessel of radius 100 µm, at a pressure gradient of 17.5 kPa m^{-1}.

(2)

$\frac{c}{o} \times 100$ $155 - 62 = 93$

$\frac{93}{62} \times 100 = 150$

Answer 150%.

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Examiner Comments

A consequential error was applied from mark point one provided that the values used were reasonable.

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Examiner Tip

Always show your working as there are often method marks, even if your final answer is incorrect.

Question 7 (c)

This was the first of our two levels-based questions and candidates were clearly more prepared for them. The more able candidates knew that all aspects of the question had to be addressed if the higher marks were to be awarded, i.e. in this question, for a level 3 to be awarded candidates had to discuss both graphs and talk about double fertilisation. When looking at these responses it must be remembered that what is printed in the mark scheme is only indicative content and candidates may gain credit for points made that are not listed.

Analyse the data to explain the role of double fertilisation, xylem and phloem in the development of the berries.

(6)

In double fertilisation one male haploid nuclei fertilizes the female haploid nuclei in the ovum which forms the berry, the second haploid nuclei ~~fo~~ fertilizes the polarbodies to form a triploid endosperm which provides nutrients for the berries to grow. the xylem is needed in the formation of berries to bring water to the berries to allow cells to grow but is not needed in ripening as not getting bigger, needs faster flow in xylem than phloem as water also lost by transpiration + some nutrients provided by triploid endosperm so need less sucrose from phloem. Needs sucrose from phloem as meristematic tissue and is a sink and can't photosynthesise so needs phloem to deliver glucose + sucrose made in photosynthesis to make polysaccharides which allow it to grow + ripen. Berries required glucose which is formed by photosynthesise so uses up the radioactive carbon dioxide. Xylem only needed for first 60 days to supply water to berry. As berry forms need greater flow of water from xylem and ~~nutrients~~ sucrose from phloem so increased rate as larger so ~~to~~ used up quickly.

(Total for Question 7 = 14 marks)

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Examiner Comments

This was awarded six marks. The candidate starts off describing double fertilisation and then makes a comment about xylem and then several comments about phloem, using information in both graphs.

ResultsPlus
Examiner Tip

Look carefully at the structure of the question, identifying the component parts. Then ensure that each part gets at least two mentions, or play safe and give at least three comments, to access the higher marks.

Analyse the data to explain the role of double fertilisation, xylem and phloem in the development of the berries.

(6)

phloem is needed for the development of fruit, to deliver sucrose to the fruit, this is seen on graph 1 where rate of flow in phloem increases in accordance with the ripening of berries.
xylem is needed in the formation of berries, along with the phloem, to deliver water and minerals to the fruit. This is seen on graph 1 wher ~~xxx~~ rate of flow in the xylem increases during the formation of berries.

ResultsPlus
Examiner Comments

This candidate made a number of points relating to graph 1. We felt that this was sufficient for a level 2 response.

ResultsPlus
Examiner Tip

If you do not address all aspects of the question you will not meet the criteria for a level 3 response.

Analyse the data to explain the role of double fertilisation, xylem and phloem in the development of the berries.

(6)

Double fertilisation ~~is~~ occurs in plants as 2 male nuclei fuse with the female gamete. This means that there is fertilisation twice meaning the development of fruit can occur. The flow of water (through the xylem) stopped once berries ~~this~~ were formed which was 60 days after fertilisation. However sucrose flow (phloem) did not stop until berries were ripened at 120 days after fertilisation. Xylem was used to transport water + the phloem was used for sucrose so that photosynthesis + respiration could occur. The berries removed from the exposure of ^{14}C had a higher % of ^{14}C in their leaf (65%) at 10°c compared to the berries left which had a % of 50.5%

ResultsPlus
Examiner Comments

This candidate has made an attempt to address all aspects of the question; however there are several errors. This did not score better than a good level 1 response.

Question 8 (b) (i)

Candidates made a good attempt at this question, but few made sufficient points to score all four marks. The mark point seen the least was the last one which is the point that finishes the story. Less able candidates got confused between selective medium and indicator medium and thought that using aseptic technique contributed to the isolation process.

(b) A scientist studied the growth of *Salmonella*.

(i) *Salmonella* was isolated from a mixed culture of bacteria, using streak plating onto selective media.

Explain why this is a suitable method for isolating the *Salmonella*.

(4)

This is suitable because the selective media should only allow the Salmonella to grow as it should be selected to ensure only Salmonella nutrients is on the agar so only salmonella can grow. However, streak plating is also used so that colonies can be separated. Therefore, if there is any other bacteria on the agar then a few colonies of Salmonella can easily removed and cultured on another plate. The growth can also is better studied when the bacteria is isolated and the colonies are separated so they are easier to view.

ResultsPlus
Examiner Comments

This is one example of a good response, scoring mark points 1, 4 and 5.

ResultsPlus
Examiner Tip

Do not repeat the stem of the question in your answer, which is what this candidate has done at the end. Candidates will not be rewarded for this.

(b) A scientist studied the growth of *Salmonella*.

(i) *Salmonella* was isolated from a mixed culture of bacteria, using streak plating onto selective media.

Explain why this is a suitable method for isolating the *Salmonella*.

(4)

• Selective media ensures that only the desired /isolated bacteria is cultured, by providing conditions optimal for Salmonella growth (pH, nutrients etc.)

• Streak plating when uses only small amounts of the culture, to disperse the culture across the agar enough so as to be able to see individual colonies. This ensures that you will isolate only Salmonella (not a mixture) whilst also using small volumes to minimise risk of infection of humans.

ResultsPlus
Examiner Comments

Another reasonable response, scoring mark points 1, 2 and 4.

ResultsPlus
Examiner Tip

If there are four marks available for a question then you must give at least four points in your answer.

Question 8 (b) (ii)

The majority of candidates attempted this calculation but there were the expected errors of not taking log values and not giving the final answer to a sensible number of decimal places.

(ii) The scientist made a broth culture of *Salmonella* at a concentration of 5×10^3 cells per cm^3.

Ten hours later the concentration of *Salmonella* was 4×10^6 per cm^3.

Calculate the exponential growth rate constant (k) for this culture of *Salmonella* using the formula

(3)

$$k = \frac{\log_{10} N_t - \log_{10} N_0}{0.301 \times t}$$

$$k = \frac{\log_{10} 4\times10^6 - \log_{10} 5\times10^3}{0.301 \times 10}$$

$$k = \frac{6.6 - 3.699}{3.01}$$

$$= 0.9645.$$

Answer 0.96

ResultsPlus
Examiner Comments

This is an example of how to lay out a calculation.

ResultsPlus
Examiner Tip

It is a good idea to show all the steps of working as candidates may get method marks even if mistakes have been made somewhere in the calculation.

(ii) The scientist made a broth culture of *Salmonella* at a concentration of 5×10^3 cells per cm^3.

Ten hours later the concentration of *Salmonella* was 4×10^6 per cm^3.

Calculate the exponential growth rate constant (k) for this culture of *Salmonella* using the formula

$$k = \frac{\log_{10} N_t - \log_{10} N_0}{0.301 \times t}$$

(3)

$$K = \frac{(\log_{10} \times 4 \times 10^6) - (\log_{10} 5 \times 10^3)}{0.301 \times 10}$$

$$\frac{4000000 - 5000}{0.301 \times 10} = 13272242.525$$

Answer .....

ResultsPlus
Examiner Comments

This candidate did not take log values but we allowed a consequential error for this.

ResultsPlus
Examiner Tip

Think carefully about how many decimal places to have in your final answer if you are not told how many to use in the question.

Question 8 (b) (iii)

Candidates seemed to have a good understanding of the growth curve and how to use it in calculations. Difficulty in expressing answers caused a loss of marks for some candidates.

(iii) In this calculation, the scientist did not allow for the time that the *Salmonella* spent in the lag phase.

Explain the effect that this will have on the calculated value for the growth rate constant.

(3)

The lag phase means that, for a period of time, the population will stay close to constant as the bacteria acclimatise to their new environment and take up nutrients. This means the actual time taken for this growth is less than the reported ten hours, meaning the bottom of the fraction will be smaller. This means the overall value of the growth rate constant will increase above the value calculated above.

ResultsPlus
Examiner Comments

All three of our mark points are in this response.

Question 9 (a)

This calculation caused candidates a lot of problems as they were not able to work out how many tonnes of soya beans were produced in Brazil. Consequential errors were applied for each subsequent step of the calculation.

9 Soya beans are an important crop for the production of food and oil.

(a) In the 2012 to 2013 growing season, production of soya beans was highest in the United States and second highest in Brazil.

The United States produced 93 million tonnes of soya beans from 31 million hectares.

This was 9.4% more than Brazil produced from 28 million hectares.

Calculate the difference in the yield per hectare of soya beans from these two countries.

(3)

USA

$\frac{93 \times 10^6}{31 \times 10^6} = 3$ tonnes per hectares

Brazil

$x \times 1.094 = 93 \times 10^6$

$x = 85 \times 10^6$ tonnes for 28 million hectares

$\frac{85 \times 10^6}{28 \times 10^6} = 3.036040742$

$3.036040742 - 3 = 0.036$

Answer 0.036 tonnes

ResultsPlus
Examiner Comments

This candidate was able to work through the calculation methodically to arrive at the correct value.



Lay out your working clearly and methodically to help work through a calculation logically.

9 Soya beans are an important crop for the production of food and oil.

(a) In the 2012 to 2013 growing season, production of soya beans was highest in the United States and second highest in Brazil.

The United States produced 93 million tonnes of soya beans from 31 million hectares.

This was 9.4% more than Brazil produced from 28 million hectares.

Calculate the difference in the yield per hectare of soya beans from these two countries.

(3)

$\frac{93,000,000}{31,000,000} =$ USA = 3 tonnes / hectare.

$\frac{93\,000\,0000}{100}$

$x \cdot 9.4 = 8742000$

Answer 0.009 tonnes per hectare.

$93,000,000 - 874,2000$

$= 84\,258000 =$ Brazil

$\frac{84\,258\,000}{28,000,000} = 3.009214286$

-3

$0.009214286.$

ResultsPlus
Examiner Comments

This candidate did not work out the number of tonnes produced by Brazil correctly, but the rest of the calculation was correct ,so two marks could be awarded.

ResultsPlus
Examiner Tip

Always attempt the calculations, as you might pick up consequential error marks even if you go wrong. Note how this candidate has rounded up their answer to a sensible number of decimal places.

Question 9 (b) (i)

This was the second of our two levels-based questions. In order to access level three, conclusions had to be made about the nutritional content of the soya beans from the data presented in both tables.

*(i) Analyse the data to assess the nutritional content of soya beans from transgenic and from non-transgenic soya bean plants grown in these two regions.

(6)

In Ponta Grossa the transgenic plants had more of all three mineral ions per 100g than the non-transgenic plants as they were able to withstand more disease and less affected by pests so actively take up ions and ions could diffuse in. Whereas in Londrina the Non-transgenic plants had significantly higher levels of all three minerals 0.72 mg more so the transgenic beans were actually effective.

~~Similarly for organic content~~ For organic content the transgenic beans had higher levels of lipids in the beans in both areas but the non-transgenic plants had ~~be~~ higher levels of carbohydrates in both areas this may because there were more enzymes to catalyses condensation of glycosidic bonds. In Ponta Grossa Transgenic plants had more protein as more peptide bond formation and more nutrients to build amino acids as less eaten by pest and ~~unsaturated~~ fatty acids replaced by ~~oleic~~ acids but in Londrina Non transgenics had higher levels of protein*. Overall transgenic beans increased nutritional content in soya beans only in Ponta Grossa.

* In Londrina more mineral ions overall for transgenics and non transgenics than in Ponta Grossa, also Londrina has higher content of ~~organic molecules~~ for ~~bo~~ proteins and carbohydrates overall but Ponta Grossa has higher lipid content. Overall beans from Londrina have a higher content of nutrients.

ResultsPlus
Examiner Comments

This candidate made several comments about both tables of data and then made a couple of conclusions about the nutritional content of the soya beans towards the end of their response. A good level three response.

ResultsPlus
Examiner Tip

Read the question carefully to identify what is being asked. The tables of data show *mineral* content and *organic* content, but candidates are being asked about the *nutritional* content of the soya beans.

*(i) Analyse the data to assess the nutritional content of soya beans from transgenic and from non-transgenic soya bean plants grown in these two regions.

(6)

In Ponta Grossa, Transgenic plants have more iron, copper and ~~magnesium~~ manganese, as well as more protein and lipids although less carbohydrates. ~~In Londrina~~ than non transgenic plants in Londrina, transgenic plants have ~~more~~ less iron, copper and manganese as well as less protein and carbohydrates but more lipids. The transgenic plants ~~in~~ produce a better variety of minerals in the soil of Ponta Grossa than Londrina which has more even though the transgenic plants have been modified, ~~they are~~ glyphosate makes them a bit ~~more~~ less effective in some soils in some areas. However, the transgenic beans in Londrina still have a higher nutrient content than the soybeans from both the transgenic and non transgenic plants in Ponta ~~G~~ Grossa. The soil in Londrina seems to be better for growing soya beans

may have up different minerals in diff. quantities

ResultsPlus
Examiner Comments

This candidate has made a few points about the data tables and made at least one conclusion. A good level two response.

*(i) Analyse the data to assess the nutritional content of soya beans from transgenic and from non-transgenic soya bean plants grown in these two regions.

(6)

The results from table one do show that londrina ~~pp~~ produces soya beans with higher amounts of iron copper and manganese than ponta ~~Grosas~~ Grossa. Table 2 also shows that Londrina soyabeans contain more protein and carbohydrates than ponta grossa however ponta Grossa produces soya beens with ahigher amount of Lipids. ~~All about for both transgenic and non transgenic~~

Both tables show that non-transgenic plants produce soya bean with slightly higher amounts in all the nutritional conten except Lipids were transgenic has slightly more. However the difference in some Lig the Lipids show such a small difference of 0.1 mg per 100g that it ais ~~mostly~~ almost not different at all

ResultsPlus
Examiner Comments

A couple of comments and a conclusion is only really enough for a good level one mark.

Question 9 (b) (ii)

This question was not high-scoring partly because it was at the very end of the paper, partly because candidates did not read it carefully enough and answered it in the same way as question 9(b)(i) and partly because they did not make anywhere near five points.

(ii) The soil in Londrina is more fertile than the soil in Ponta Grossa. Londrina has higher temperatures and rainfall during the growing season.

Explain the differences in the nutritional content of soya beans grown in these two regions.

(5)

Londrina soil is more fertile ∴ there is a higher mass of ions absorbed into the plant. Compared to Ponta grossa. Londrina is able to photosynthesise more as there are higher temperatures and more water availability ∴ able to produce more organic content from the light dependent reaction.

In Ponta Grossa ∴ lower temps reduce enzyme activity activity + reduce ~~the~~ rate of reaction.

ResultsPlus
Examiner Comments

This candidate has demonstrated that it is possible to score well on this question. Mark points 1, 3, 5 and 4 were awarded.

ResultsPlus
Examiner Tip

Always check the mark allocation for a question, and the wording of the question, to help scaffold the answer. The stem of this question mentions fertile soil, higher temperatures and higher rainfall so these are what you must write about.

(ii) The soil in Londrina is more fertile than the soil in Ponta Grossa. Londrina has higher temperatures and rainfall during the growing season.

Explain the differences in the nutritional content of soya beans grown in these two regions.

(5)

There is more nutritional content in soya beans in Londrina as the plant has access to more water and minerals due to the rainfall and fertile soil.
The soya beans in Londrina have on average for the iron, copper and manganese a 0.8mg/100g difference While the protein, lipids and carbohydrate content is about 2.0mg/100g higher. This could also be due to the higher temperatures

ResultsPlus
Examiner Comments

This candidate has picked up on the more fertile soil and the higher temperatures and rainfall but then written again about the data.

ResultsPlus
Examiner Tip

Always identify the command word. In this question it is *explain* which means you need to use some Science to say *why* Londrina had more nutritious soya beans.

Question 9 (b) (iii)

This was very low scoring question as candidates interpreted the question to mean: write everything you know about the fatty acid content of soya beans.

(iii) Explain why this study also analysed the types of fatty acid found in soya beans from transgenic plants and from non-transgenic plants.

(2)

- Linoleic acid (~~was~~ high in non-transgenic plants) is more easily oxidised and higher in polyunsaturated fats.
- Oleic acid (higher in ~~less~~ transgenic plants) is higher in ~~mono~~ monounsaturated fats, which is healthier for the heart.
- The study ~~is~~ is comparing levels of fatty acids to determine how much of a health benefit transgenic plants can provide.

ResultsPlus
Examiner Comments

This candidate did read the question carefully and answered it fully.

(iii) Explain why this study also analysed the types of fatty acid found in soya beans from transgenic plants and from non-transgenic plants.

(2)

Non-transgenic plants contain more linoic acid which is a more unhealthy fatty acid. Transgenic plants replace this fatty acid with oleic acid which is healthier

ResultsPlus
Examiner Comments

This candidate wrote what they knew about the fatty acid content of soya beans, which is far too vague.

Paper Summary

Based on their performance on this paper, candidates are offered the following advice:

- in the levels-based questions, identify all the component parts of the question e.g. for question 7(c) you needed to write about double fertilisation and xylem and phloem, using information in two graphs
- identify the command word in a question to help you work out what to write e.g. question 3(c) has the command 'compare and contrast' which means that you must write about differences and similarities in pairs
- check the mark allocation for a question to help you decide how much to write e.g. question 9(b)(ii) has five marks allocated to it so you must write five statements
- show all your working out in calculations as there might be consequential error marks e.g. in question 9(a) you could still score two marks even if you could not work out the number of tonnes of soya beans produced by Brazil
- read data from graphs accurately e.g. question 4(c)(i) and 7(b)(ii) required accurate values to be read from the graph
- if you are asked to draw a diagram, it needs to be accurate and the label lines must touch the parts that they are pointing to e.g. question 5(a)
- even if a question seems straightforward, think very carefully about how you answer it e.g. question 7(a)(i) seems a very straightforward multiple-choice question, but few candidates realised that sucrose must be dissolved in water if it is to be transported.

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:

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