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Int Advanced Level Biology WBI13 01

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Introduction

This paper generated broadly similar results to previous series. However, there were a few areas that candidates had difficulty with. Yet again, a lack of familiarity with a command word caused one of the biggest problems. In the last June series, the command word evaluate caused major difficulties for candidates. On this occasion, it was the command word justify, used in 2a, with which they struggled. As noted last year, this is one of the command words that candidates are expected to be familiar with. Although it may not have been used much on this unit, it will have been encountered on others, and therefore candidates are expected to have seen it and thought about its meaning when doing past paper exercises. Any of the command words, listed in Appendix 7: Taxonomy may be used on any of the units at any level. In terms of teaching and learning strategy, then, a thorough understanding on what command words are asking for should be developed.

The other question which the statistics showed was found to be difficult was 1biii. It is not so obvious why this proved so much of a problem for them.

The other questions which were similarly challenging were1ciii, 3aii, 3bii and 3biii.

The less challenging questions were 1a, 1cii, 2aii-iii, 3ai and 3bi.

Question 1(a)

This had been intended as an easy starter to the paper, and in the event proved so. There were very few answers which did not include correct stages in cell cycle, but some included stages outside of mitosis and occasionally had them in the wrong order.

Answer ALL questions.

Write your answers in the spaces provided.

1 Trifluralin is a chemical used to stop the growth of weeds in fields of crops.

Mitosis is a process that is essential for the growth of weeds.

(a) State the **four** stages of mitosis in the order in which they occur.

(2)

1 Interphase

2 Metaphase

3 Anaphase

4 Telophase

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Examiner Comments

This is one of the very few that did not get full marks on this starter question. Only three of the stages quoted are stages of mitosis and, by having an incorrect stage at the beginning, a stage (prophase) is missed.

Question 1(b)i

Most candidates who realised that this question was about involvement of enzymes in the process of mitosis were able to get both marks. A significant proportion, however, went down the route of the prevention of growth of pathogens, having not fully understood exactly what was going on in the experiment.

(i) Explain why a temperature of 25 °C was used.

(2)

This lessens the probability of the bacteria being able to mutate or contaminate other surfaces. this is good because it decreases the chance of a human being infected.

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Examiner Comments

This is typical of a relatively large number of candidate answers which assumed that this was a microbiological investigation, presumably due to the use of Petri dishes.

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Examiner Tip

Always read the stems of questions very carefully. It is clear that many candidates carried a piece of information from the stem, a Petri dish was used, over to their attempt to answer this question. What they had not carried over was that the Petri dish was being used to grow wheat seedlings, not microorganisms. It is with microorganisms that most candidates will have had their experience with Petri dishes, but this does not mean they cannot be used for other purposes, as here. This misunderstanding led to a loss of marks in this question and in a later one, so was quite costly for those who perpetrated it.

Question 1(b)ii

There is a question on every paper which will test learners' understanding of variables. Dependent (DV), independent (IV) and control (CV). They should be accessible to most candidates, but every year we are surprised to see a proportion getting it wrong. In this series over a third of candidates did so.

(ii) State the independent variable in this investigation.

(1)

Concentration of trifluralin

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Examiner Comments

The presence or absence of trifluralin was the answer we were expecting here. However, a number of candidates suggested concentration, and it was decided that since there are two concentrations, 7 mg cm –3 and 0 mg cm –3 , we could allow either. So, this answer got the mark.

(ii) State the independent variable in this investigation.

(1)

The solvent filter paper discs soaked in

ResultsPlus
Examiner Comments

Although the trifluralin was presented to the roots in a solvent, the solvent itself was not the independent variable. Had this answer gone on and said "the solvent filter paper disc was soaked in, whether it contained trifluralin or not" it would have got the mark.

(ii) State the independent variable in this investigation.

(1)

effect of trifluralin

ResultsPlus
Examiner Comments

Although the keyword which gives a way into this mark is in this answer, the context is wrong as the effect is the dependent variable not the independent one.

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Examiner Tip

Try to be very clear in your mind about the meaning of independent and dependent variables and make a real effort to apply your understanding to the particular situation you are trying to deal with.

(ii) State the independent variable in this investigation.

(1)

presence ~~of~~ of trifluralin.

ResultsPlus
Examiner Comments

This answer gained the mark. It was not necessary for candidates to talk about the presence and absence, just presence would do.

Question 1(b)iii

Here candidates are being asked to think about experimental design in a situation which is, or should be, familiar to them, but in a rather new context. This kind of question is typical on this paper.

(iii) Give **two** reasons why the grains were germinated before being transferred to the Petri dishes.

(2)

1 To confirm that growth will occur

2 To make the process quicker.

ResultsPlus Examiner Comments

One of the basic ideas we wanted to see here was that a 'viability of seeds' test was needed. Candidates expressed this in many ways, "to confirm that growth will occur" was just enough for this mark. It would have been more accurate to say to confirm that germination will occur.

(iii) Give **two** reasons why the grains were germinated before being transferred to the Petri dishes.

(2)

1 Because they need space to grow

2 Sowing to ensure that all the grains have germinated the same length and don't have any anomalies

ResultsPlus
Examiner Comments

This is potentially a good answer in its second part. Ensuring that all the grain (?) have germinated is clearly fine for one mark. The next part may say the same height and don't have any anomalies. However, it is too difficult to be sure, and it is not therefore enough for the mark point about all starting treatment at the same stage.

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Examiner Tip

Do make a real effort to make sure that your handwriting is legible. If you have any fears about an examiner being able to read what you've written, you should speak to your teacher or tutor about the possibility of typing your paper. Please bear in mind, however, that this method also has its pitfalls as, if you are not a reasonably competent typist it's possible to end up with a lot of spelling mistakes as you are not allowed to use a spellchecker if typing your exam.

(iii) Give **two** reasons why the grains were germinated before being transferred to the Petri dishes.

(2)

1 they cannot be grown if the petri-dish is closed as it doesn't have suitable conditions

2 petri-dish is not moist

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Examiner Comments

This was quite a common assumption about what was going on with the Petri dish. They were interpreting it as just a dish, either glass or plastic, in which there was nothing. So here the suggestion is that it is not moist and that there are not suitable conditions, although the latter would be far too vague to gain the mark under any circumstances. What they were told in the stem of the question was that the germinating seeds will be transferred to a petri dish containing a filter paper disc soaked in a solvent. So, it is clearly not an empty dish, and the photograph tells them it is not closed. Due to these misunderstandings and incorrect reading of the stem this candidate gains no marks.

Question 1(b)iv

(iv) Explain why some seedlings were placed in the solvent **without** trifluralin.

(2)

As a control group to ~~see~~ have a fair comparison (between the two groups) and to see whether it's the trifluralin that affects the mitosis and not something ~~else~~ else

ResultsPlus
Examiner Comments

What was required here were firstly, that seedlings placed in the solvent without trifluralin represented a control. An alternative way of putting this would have been to have said that it would allow comparison between the experimental and the control group. This answer gives both possibilities and gains that mark. The other mark was for candidates who addressed the idea that it was to eliminate the possibility of anything else causing any effect that was seen, rather turning the first mark point on its head. This was less frequently seen, but this particular response did enough to get that mark. What ensured it for this response was the phrase "not something else". Another way of doing this would have been to have quoted some specific "something else" which could have affected mitosis, such as the solvent.

(iv) Explain why some seedlings were placed in the solvent **without** trifluralin.

(2)

Some were placed in solvent without trifluralin as a control variable to see effect of trifluralin on other seedlings.

ResultsPlus
Examiner Comments

Unfortunately, a common error when talking about controls is to add the word variable, as here. Candidates should be clear that a control, as in a controlled experiment, is not the same thing as a control variable (CV). The addition of that word lost them the mark in this answer.

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Examiner Tip

Be absolutely clear in your mind about the difference between a control, as used in the idea of a controlled experiment, and a control variable, which is sometimes referred to as a non-experimental or confounding variable. They are not the same thing.

Question 1(c)i

Questions in which the basic details of a call, practical or recommended, additional practical are required, will almost certainly crop up on this paper.

(i) Describe how a root sample could have been prepared and examined to obtain these results.

(4)

- Cut the root tip off
- put it in acid
- put it in ~~orcic~~ acetin orcic / dye / stain
- root tip squashed
- then placed on a slide
- cover slip added
- put slide on the stage of a light microscope and secure with stage clips
- use a high power (setting/magnification)
- count the total number of cells
- count the number of cells in mitosis
- from different/various fields of view
- calculate the mitotic index.

- Mitotic index = $\frac{\text{number of cells in mitosis}}{\text{total number of cells}} \times 100$

ResultsPlus
Examiner Comments

This response gives a very clear account of how this piece of practical work should be carried out. Clarity is increased by the presentation using bullet points. We can tick off the mark points: Cut off the root tip, MP1 Put it in acid, MP2 Put it in acetic orcein, MP3, Squash it, MP4, View through high power on the microscope, MP5 Count the cells which are showing stages of mitosis, MP6. Many candidates gained full marks on this question. This is one of the required core practical.

(i) Describe how a root sample could have been prepared and examined to obtain these results.

(4)

A small sample from the roots or base of the seedlings in each Petri dish should be obtained by carefully cutting them into equal-sized pieces. Use an electron microscope for higher resolution and to therefore be able to distinguish the root cells' stages of mitosis from each other. Under the microscope, prophase, metaphase, anaphase and telophase all have significant and noticeable differences.

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Examiner Comments

The detail given is incorrect for the mark. A small sample from the roots cut into equal size pieces does not convey what is needed. To invoke an electron microscope shows that the candidate does not understand or remember the practical.

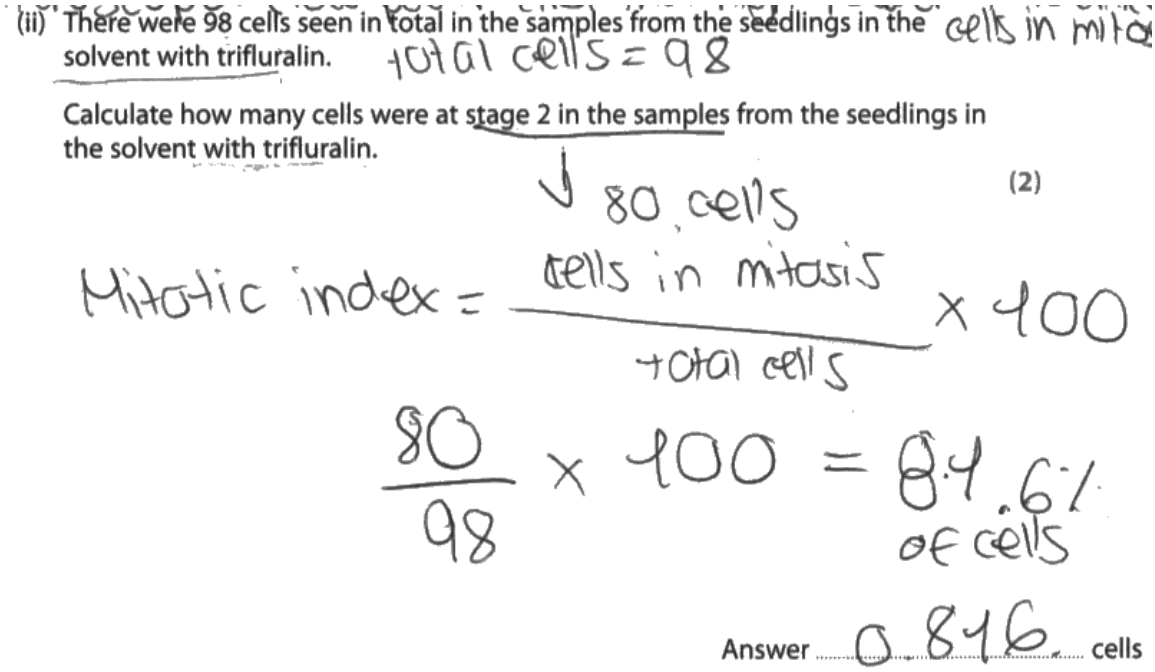
ResultsPlus
Examiner Tip

Do everything you can to have experience with all of the core and recommended additional practical on the syllabus. The ideal thing is to carry them out in the laboratory at school or college. Another possibility is that you have them demonstrated to you by a teacher or lecturer. Yet another is that you have been shown a video of the practical being carried out. On this paper, any of the nine core practical and five recommended additional practical in the AS part of the syllabus could be examined.

Question 1(c)ii

The first skill being tested here was the ability to derive the correct information from the graph with which the candidates have been presented. So, they needed to take on board the information that they were needing to find out the percentage of cells in stage two. So, there was one mark available for reading 80% from the graph. Wherever the number 80 appears in the answer, it will gain the mark. The next step is to do the right thing with the 80%, that is find 80% of the 98 cells which were seen.

Nearly all candidates got a mark for reading off the number 80 correctly. However, only about 2/3 were able to convert this into a second mark by multiplying 98 x 0.8 to give the answer of 78.4, which then needed to be rounded to 78 as it is not possible to have 0.4 of a cell.


(ii) There were 98 cells seen in total in the samples from the seedlings in the solvent with trifluralin. total cells = 98

Calculate how many cells were at stage 2 in the samples from the seedlings in the solvent with trifluralin. (2)

80 cells

Mitotic index = cells in mitosis / total cells × 100

80/98 × 100 = 81.6% of cells

Answer 0.816 cells

ResultsPlus
Examiner Comments

The candidate in this response missed the second part, having obtained the number 80, but then dividing it by 98.

(ii) There were 98 cells seen in total in the samples from the seedlings in the solvent with trifluralin.

Calculate how many cells were at stage 2 in the samples from the seedlings in the solvent with trifluralin.

(2)

$\frac{80}{98}$ ~~[illegible]~~ = 81.63

Answer 81 cells

ResultsPlus
Examiner Comments

81 is not the correct answer, so if that was all that this candidate had written then they would have scored zero. However, it is clear that they have read the number 80 off the graph and this was all that was required for the first mark point, as shown by the working out.

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Examiner Tip

Always show your working in calculation questions because, no matter how confident you are, in the stress of an exam you may get the calculation wrong, and you'll get no marks if there is no working for the examiner to look at.

(ii) There were 98 cells seen in total in the samples from the seedlings in the solvent with trifluralin.

Calculate how many cells were at stage 2 in the samples from the seedlings in the solvent with trifluralin.

(2)

$80\% \times 98 = \frac{80}{100} \times 98 = 78.4$

Answer 78.4 cells

ResultsPlus
Examiner Comments

Apart from answers that were correct, and those that came to know even partially correct conclusions, the commonest answers seen were those that quoted 78.4 on the answer line, is here. Rounding or quoting answers to a specified or implied number of significant figures is often the cause for loss of marks in calculation questions on this examination. Here, no rounding, number of significant figures or number of decimal places was suggested. So all candidates can do in order to quote their answer in the right way is to apply common sense and logic. In this case they were asked to "calculate how many cells……". It is incorrect to have 0.4 of a cell so the answer cannot be 78.4 and be correct.

Question 1(c)iii

This question was pleasingly well answered by a large proportion of candidates. Nearly a 1/3rd gaining all three marks and further 40% two marks. Noting that mitosis seems to have been halted during metaphase or not carried on into anaphase or telophase was the first step, information which could be deduced from the data supplied. Candidates were then expected to apply knowledge of the mitotic process to suggest what may have caused the cessation of mitosis. Many were able to do so.

(iii) Explain the effect that trifluralin could have on the processes in mitosis.

(3)

Trifluralin decreases the number of cells in prophase, then increases the number of cells in metaphase and prevents cells from anaphase and ~~t~~ telophase. This ~~might be caused~~ Trifluralin may ~~effect on~~ inhibit the activity of spindle fibers that are involved in mitosis and are needed to seperate sister chromatids in ~~the~~ anaphase. Therefore trifluralin stops the process of mitosis and thus stops the growth of ~~root~~ wheat plants. weeds.

(Total for Question 1 = 18 marks)

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Examiner Comments

After some preliminary and inaccurate statements about trifluralin's effects on prophase and metaphase, this one goes on to clearly state that it has prevented cells from entering anaphase and, of course, subsequently telophase. It then explains its possible effects on the spindle and subsequent separation of chromatids to gain the other two marks.

ResultsPlus
Examiner Tip

It is very often the case that questions preceded by the command word "explain" will require some sort of description. You are expected to see that this is needed and include it in your answer. In this case, in order to explain the effect that the weed killer might have on mitosis you need to describe that effect first. With some (incorrect) mention about cells in prophase and metaphase, this answer does just that.

Question 2(a)i

This question proved to be the most difficult one on the paper. This is probably due to most candidates missing or not understanding the command would **justify**. This did not mean that they did not gain any marks, but very often these marks were gained by chance. It is important that candidates are aware of the range of command words that may be used and what they all mean.

(i) Justify each step of a method that could be used to obtain the results shown in the graph.

(5)

Beetroot can be cut using a cork borrer, ~~Then it to can be~~ get cylinder. Then cut it into equally sized discs. Then use equal volumes of ~~the~~ methanol, water, methanol with 1mmoldm^{-3} and 1ummoldm^{-3} of cho~~l~~ ~~hydrochloric~~ acid and increases the ~~con~~ concentration decreases the concentration using serial dilution. At first 10%, 20%, 30%, 40%, 50%... can be used. Then place 4 discs in each test tubes with marked concentration of hydrochloric acid. Then leave it for the same amount of time 5 minutes. The measure the pigment of each test tube ~~aft~~ using colorimeter, at first ~~wat~~ it should equated for 0 for water without disc. Then it can measure ~~concentration~~ the membrane permeability by the pigment be leaked.

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Examiner Comments

This is an answer which starts well but ultimately gains no marks. The candidate refers to cutting equally sized discs but gives no reason for this. Just over halfway, they then refer to leaving them for the same amount of time for five minutes, with no reason given. The pigment is measured using a colorimeter but no reason for this choice of equipment is provided. Finally, it says the colorimeter should be "equated (sic) for 0 for water", but again no reason. So four clear procedures are mentioned, but none of them are justified.

(i) Justify each step of a method that could be used to obtain the results shown in the graph.

(5)

Cut 4 cylinders of beetroot from the middle of the beet because they will have the same concentration of pigment. Use a ruler and white tile to cut the cylinders to same length of 2cm - so that they will have the surface area to react with the solvents. Wash with distilled water until no more pigment is lost because cut cells will produce betalain that will interfere with the result. Measure the same volume of the four liquids ($5cm^3$) with a pipette to control amount of solvent. Place each cylinder into a separate test tube with the 4 liquids in one of each for the same duration of time 20 hours measured with stopwatch to ensure they all lose pigment in the same time. Carefully remove each cylinder to prevent more damage to the membrane that will affect the absorbance. Place each sample into a cuvette and stir to distribute pigment evenly. Calibrate the colorimeter with a blank to make sure the absorbance is accurate between each liquid. Plot a graph of membrane permeability and time of the experiment.

Repeat for each liquid and find average to eliminate the anomalies which will increase reliability.

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Examiner Comments

This one gained full marks. The first mark point is seen in the first two sentences in which four cylinders are cut in such a way as to have the same concentration of pigment. Then the second mark point, 5 lines further down, talks about washing with distilled water to remove excess pigment. Another five lines further on the pieces of beetroot are kept ensuring that pigment loss occurs over the same amount of time. Two further lines on, a sample from around the beetroot is removed and stirred to distribute the pigment. And then, at the end, the experiment is repeated and an average found.

Question 2(a)ii-iii

The graph plotting and table drawing questions are always high mark yielding. The statistics show that this series was no exception to this. The most common errors in table drawing are writing inadequate headings and putting the units in the cells of the table. The latter error was much less common this time around, but there were many inadequate headings, losing candidates a mark.

(ii) Draw a table that includes **only** the results obtained at 20 hours.

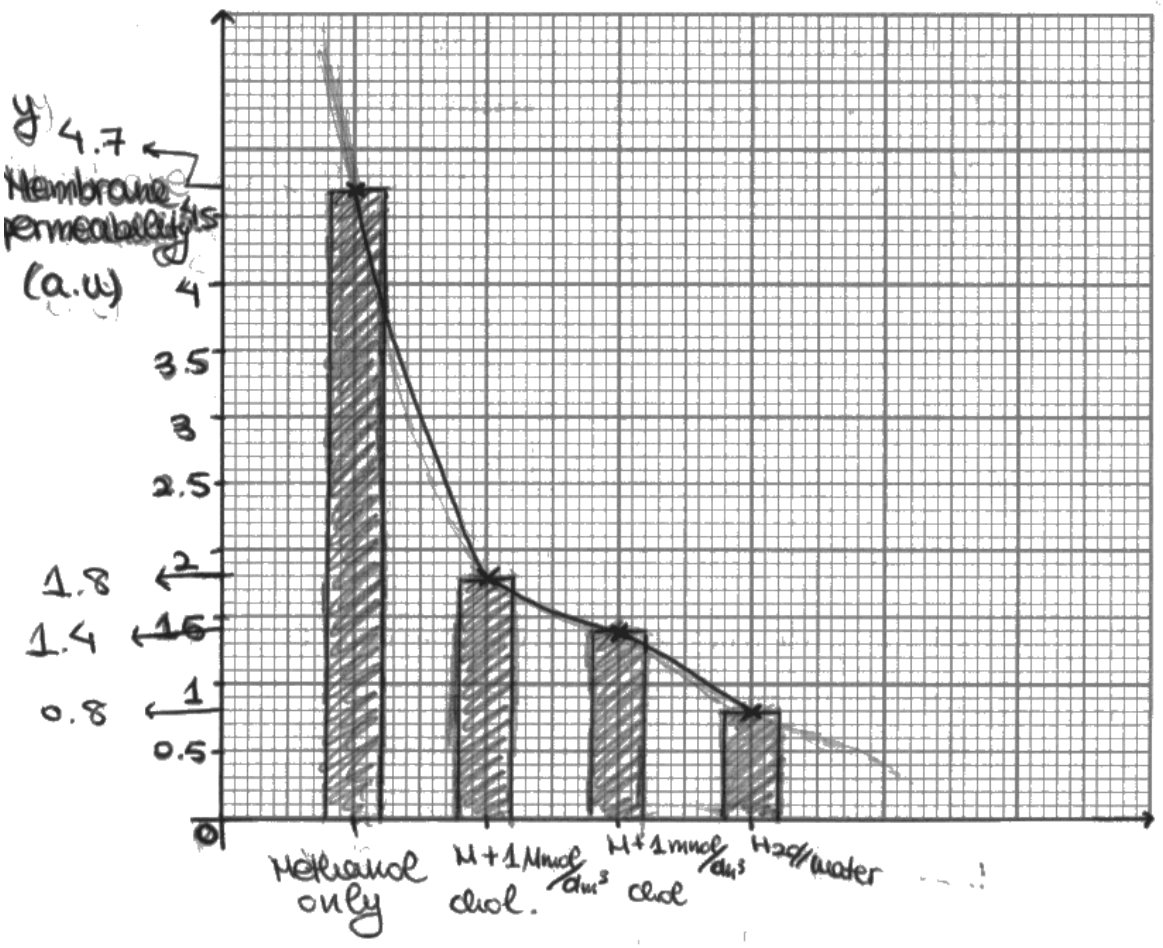
(3)

20 hours:

[illegible]	Liquids :	Methanol only	Methanol + 1 Mmol dm^{-3} cholesterol	Methanol + 1 mmol dm^{-3} cholesterol	water
[illegible]	M.P (a.u)	4.7	1.8	1.4	0.8

(iii) Plot a suitable graph for the results obtained at 20 hours.

(4)



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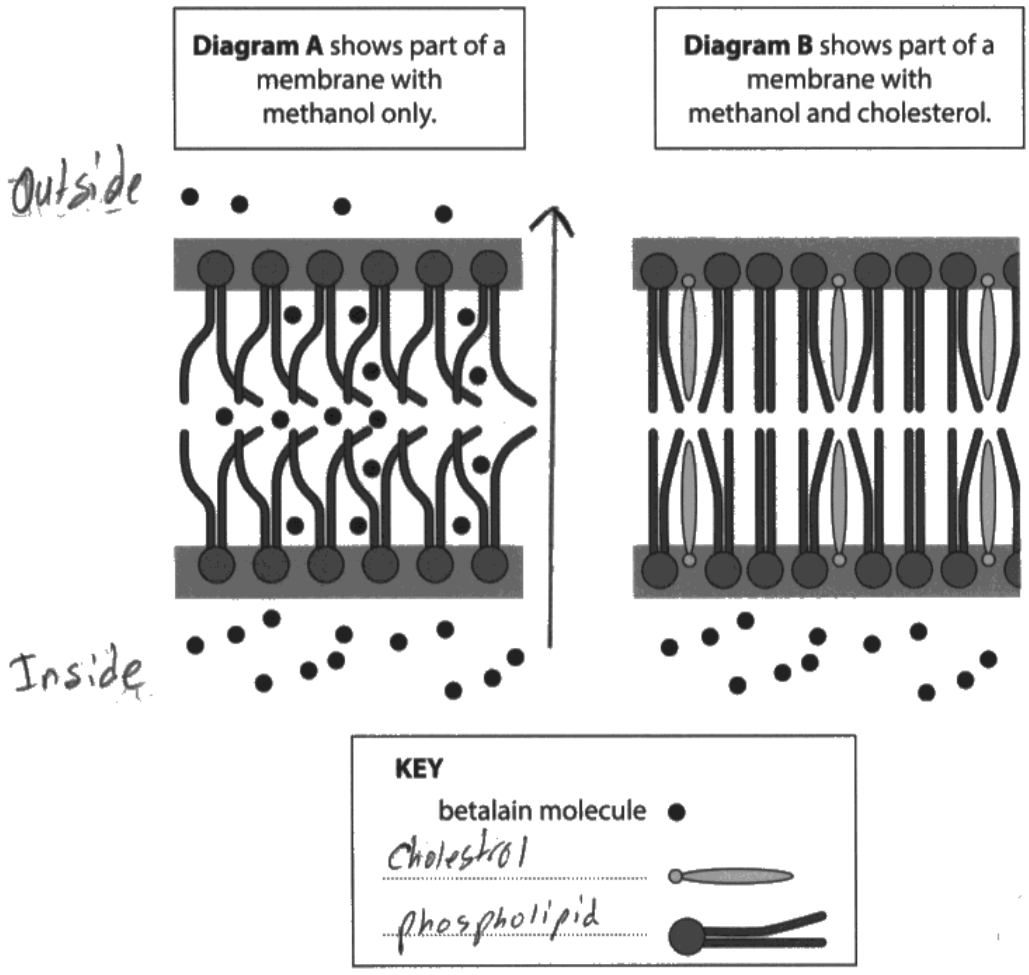
Examiner Comments

In this example, the headings are incorrect, therefore no mark. It is not clear that the membrane permeability was measured after 20 hours from the heading, and MP is not an adequate entry for membrane permeability. However, the unit can be awarded, and the data are all entered correctly. So, this achieves two marks. In the graph, the y axis is not adequately labelled as it does not have the fact that the measurement was taken at 20 hours. A more subtle error is that the candidate has plotted both a bar chart and a line graph. We will never make a choice for a candidate, so this cannot have the mark for bar chart. So again, this achieved two marks.

Question 2(b)

This question proved to be quite accessible for candidates, especially the (bi) part. Statistics are not reported for questions which are clipped together in this way, for each separate part of the question. However, the impression of the examiners was that most candidates gained two marks in part bi. The other two parts of the question were significantly less well done although still over a quarter of candidates were able to gain full marks for the three parts.

(b) The diagrams show parts of membranes around beetroot cells **soon after the experiment started**.



(i) Complete the key by naming the molecules.

(2)

(ii) Complete diagram A by labelling the inside and outside of the cell.

(1)

(iii) Draw an arrow next to diagram A to show the net movement of betalain during the experiment.

(1)

(Total for Question 2 = 16 marks)

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Examiner Comments

A clear four mark answer.

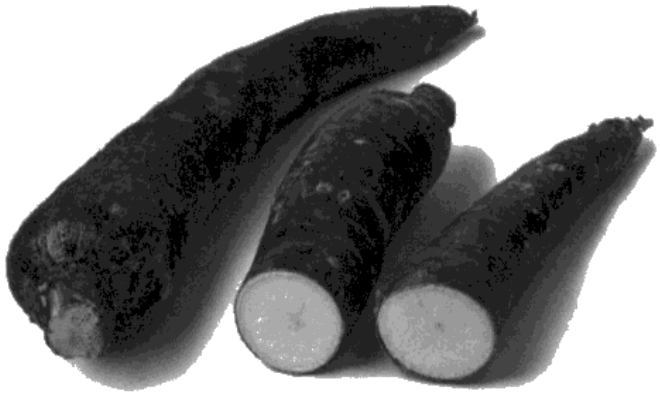
Question 3(a)i

This is the second of the two AO1 questions on this paper, between them totalling the required 10% of the marks for the paper. Like question (1a), this proved to be very accessible with many candidates gaining full marks. This is very pleasing to see.

3 Cassava is an important crop because of the high starch content of the roots.

The value of the crop depends on the starch content, so this must be assessed accurately.

The photograph shows a whole and a sliced cassava root.



(Source: © Picture Partners / Alamy Stock Photo)

(a) (i) Describe the structure of starch.

(3)

A carbohydrate monosacaroide that is highly branched and helps stores around itself which makes it a very useful molecule in which to store energy because it can be easily broken and after being broken it releases a large amount of energy. Though only plants use it as a energy storage site

A common mistake on questions that ask for structure to be described is for candidates to drift off into describing function. This was relatively rare on this occasion, but this is an example of a candidate who wrote almost entirely about function and the little bit that they did write about structure is too inaccurate to be markworthy.

Question 3(a)ii

This question was based around the core practical on semi-quantitative methods for estimating concentrations of organic materials using colour standards.

(ii) Explain how colour standards can be used as a semi-quantitative method of estimating the concentration of starch in a sample.

(3)

make equal volumes of solutions from sample using pestle and mortar to grind, adding water. add iodine to solutions until color changes than rate solutions, put in a colorimeter reset to zero and calibrated to find intensity of color, then plot a calibration curve and use it to obtain concentration of starch from sample.

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Examiner Comments

This response is chosen because it makes what was a relatively common error in this question. One mark is gained for the simple notion of adding iodine as a test reagent. Even at this level, a significant number of candidates did not quote iodine, the most common alternative being Benedict's reagent. The candidate fails to gain any further marks, as they then go into discussion of the use of a colorimeter, which of course, does not represent an example of a semi-quantitative method. This is all the more surprising as the estimation of starch in samples using semi-quantitative methods is a core practical on the syllabus.

(ii) Explain how colour standards can be used as a semi-quantitative method of estimating the concentration of starch in a sample.

(3)

Iodine can be used to test for starch content, as it turns from yellow-brown to blue-black in the presence of starch. An array of solutions with different known starch concentrations (same volume - e.g. 1cm3) can be prepared, and then the same amount of iodine (e.g. 2 drops) added to each. Then when iodine is added to the sample, the resulting colour can be compared to the standard solutions/colour standards prepared earlier in order to find the closest colour match and select that colour standard's starch concentration as the estimate.

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Examiner Comments

This gained full marks in the way that had been intended. It suggests the creation of a range of standards, the addition of iodine to both that and the unknown sample, and finally the comparison of the colours obtained for the unknown sample with the prepared colour standards.

Question 3(a)iii

The syllabus requires the study of semi-quantitative methods for the estimation of the concentrations of substances in a sample in two places, core practical 1 and the recommended additional practical on the estimation of protein. The majority of candidates gained two marks on this question.

(iii) Describe the difference between a result obtained from a quantitative test and a result obtained from a semi-quantitative test.

(2)

Quantitative is more accurate, the concentration found is more accurate and more reliable it uses colorimeter and colour intensity compared to a graph to find exact concentration.

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Examiner Comments

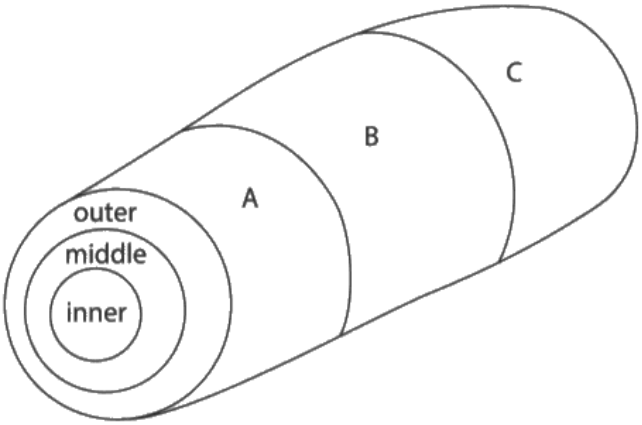
This answer is good enough to get the mark for quantitative test. It does show a feature of many candidate answers which tend to try to get marks by putting down words such as accurate and reliable, without any real understanding of what they mean or where they are appropriate. The answer never addresses semi-quantitative tests.

Question 3(b)i

(b) The starch content of nine regions of a cassava root was investigated.

The root was cut into three sections, A, B and C. Each of these sections has an outer, middle and inner layer.

The nine regions are shown in the diagram and the table.



The starch content was measured in each region in grams per hundred grams of tissue.

The table shows the results of this investigation.

Layer of section	Starch content in regions / g per 100 g of tissue		
	A	B	C
outer	31.40	31.79	29.76
middle	33.65	33.26	32.14
inner	30.06	29.64	30.56

(i) Calculate the percentage difference between the highest and lowest values obtained from these nine regions.

Use the formula:

$$\text{Percentage difference} = \left(\frac{\text{difference between two values}}{\text{mean of the two values}}\right) \times 100$$

(2)

$(33.65 + 29.64) \div 2 = 31.645$

$\left(\frac{33.65 - 29.64}{31.645}\right) \times 100 = 12.67183$

Answer 12.7 %

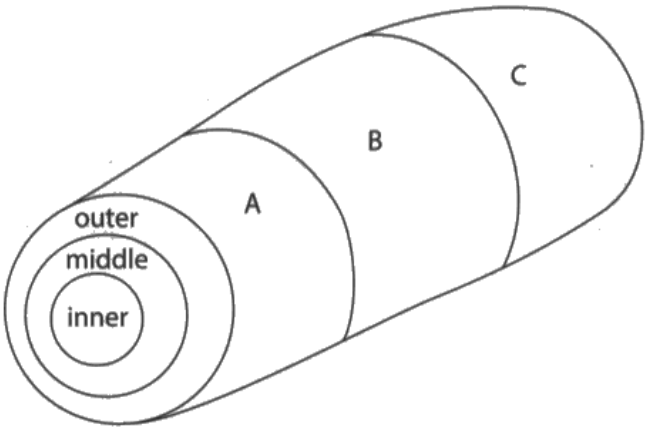
ResultsPlus
Examiner Comments

A very nicely presented correct answer which gains both marks.

(b) The starch content of nine regions of a cassava root was investigated.

The root was cut into three sections, A, B and C. Each of these sections has an outer, middle and inner layer.

The nine regions are shown in the diagram and the table.



The starch content was measured in each region in grams per hundred grams of tissue.

The table shows the results of this investigation.

Layer of section	Starch content in regions / g per 100 g of tissue		
	A	B	C
outer	31.40	31.79	29.76
middle	33.65	33.26	32.14
inner	30.06	29.64	30.56

(i) Calculate the percentage difference between the highest and lowest values obtained from these nine regions.

Use the formula:

$$\text{Percentage difference} = \left(\frac{\text{difference between two values}}{\text{mean of the two values}}\right) \times 100$$

(2)

$\frac{33.65 - 29.64}{33.65} \times 100 = 11.9187$
$= 11.92\%$

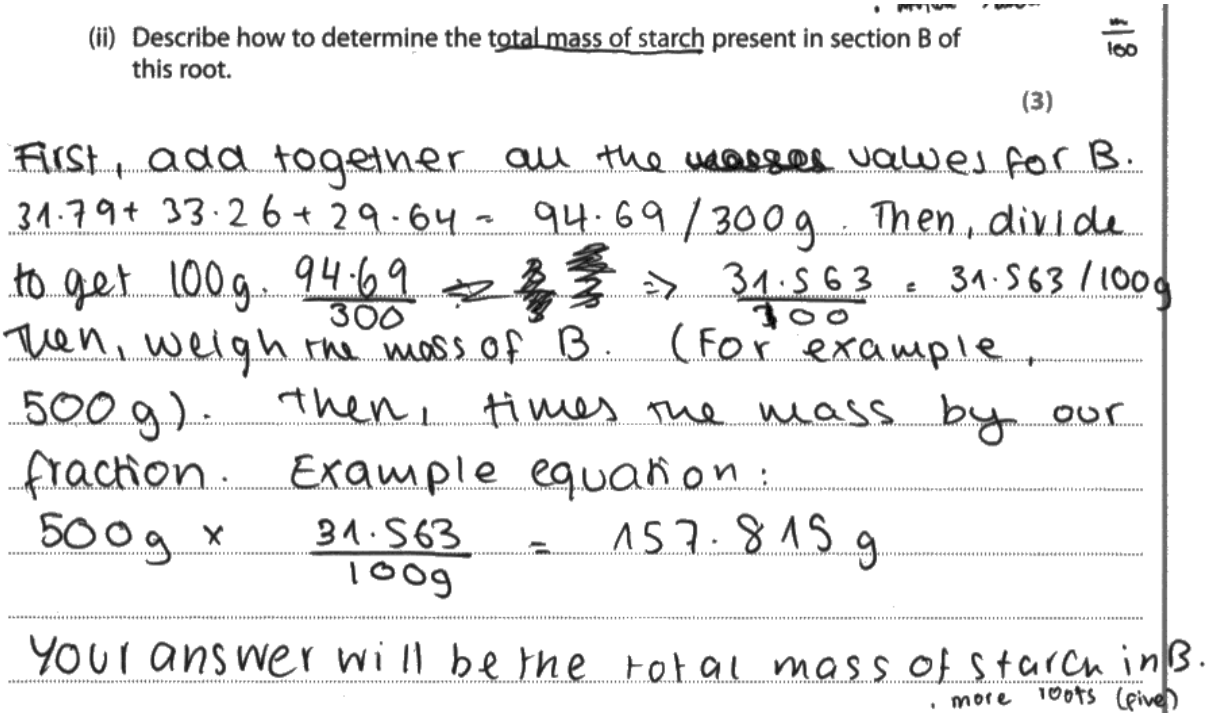
Answer 11.92 %

ResultsPlus
Examiner Comments

This answer demonstrates the importance of showing working and the requirement for examiners to see if marks can be given. To get the first mark point, candidates had to select the correct two numbers and subtract one from the other correctly, giving an answer of 4.01. This number does not appear on this script. However, the correct numbers from the table have been chosen, 33.65 and 29.64. The candidate has divided whatever they calculate the difference between these two numbers to be by an incorrect number, 33.65. This is not the mean of the two values, but the bigger of the two values. If we divide 33.65- 29.64 x 33.65 we get 0.11916. Multiplication by 100 and some rounding gives an answer of 11.92. This shows that the candidate had in fact got the number 4.01 and the requirement for the examiner to do a bit of "reverse engineering" on their final answer, allows a mark to be awarded to this candidate. Had they just written 11.92 no mark could have been given.

Question 3(b)ii

Only a small proportion of candidates gained full marks on this question.



(ii) Describe how to determine the total mass of starch present in section B of this root.

(3)

First, add together all the ~~masses~~ values for B. 31.79 + 33.26 + 29.64 = 94.69 / 300g. Then, divide to get 100g. $\frac{94.69}{300}$ => ~~3~~ => $\frac{31.563}{100}$ = 31.563 / 100g Then, weigh the mass of B. (For example, 500g). Then, times the mass by our fraction. Example equation:

$500g \times \frac{31.563}{100g} = 157.815\,g$

Your answer will be the total mass of starch in B.

. more roots (five)

ResultsPlus
Examiner Comments

This is an example of a correct response. The candidate has appreciated that the quantities of starch shown in the original diagram, if added together, would be the quantity of starch found in 300g of cassava root. They have read the figures correctly from the table and also added them correctly, to give 94.69. Dividing this total by 300 gives a starch content per gram across the three layers. Then if B is weighed and its weight multiplied by the answer to the previous calculation, this would give the starch content asked for. This very good answer has exemplified what it is trying to say with an example.

(ii) Describe how to determine the total mass of starch present in section B of this root.

(3)

Add the stalch content in the outer, middle and inner layers. Cut section B using a razor blade or a scalpel carefully. ~~Add~~ ~~Crush it~~ ~~Cut~~ Crush ~~them~~ it using a pestel ~~and~~ ~~mortar~~. ~~Add~~ ~~ethanol~~. Add it to a cuvette with ethanol. ~~Put~~ Put it in the colorimeter to determine the absorbance. ~~Add this~~ With the Starch content present ~~in~~ ~~the~~ ~~different~~ layers. Repeat this with the other two layers. Divide each by 100 and add all the values.

ResultsPlus
Examiner Comments

This answer did not gain the full marks and is a little muddled. Firstly, they have suggested that section B should be isolated, the wording is not good, but good enough for the mark. However, they suggest adding together starch, contents, presumably from the table provided, but they never do anything with the result of this addition. They go on them to discuss colorimetry and gain no further marks.

Question 3(b)iii

Many candidates picked up marks on this question by simply stating that mean, and a standard deviation should be obtained and calculated. Such candidates were often not clear about how the data to allow this calculation should be obtained.

(iii) Describe how this investigation could be extended to determine the variability in the concentration of starch in different cassava roots.

(3)

Repeat the experiment many times under same conditions, calculate the mean value, and calculate standard deviation from the mean value. Plot results on a graph with the error bars of standard deviation from the mean value. Observe the length of error bars and if they overlap or touch to indicate if there is significant difference. Length indicates reliability.

(Total for Question 3 = 16 marks)

TOTAL FOR PAPER = 50 MARKS

ResultsPlus
Examiner Comments

This answer has gained all three marks by suggesting that the experiment be repeated under the same conditions, and that a mean and standard deviation should be calculated.

(iii) Describe how this investigation could be extended to determine the variability in the concentration of starch in different cassava roots.

(3)

repeat the experiment with multiple different cassava roots the calculate standard deviation and plot error bars to see significant difference

ResultsPlus
Examiner Comments

This candidate picked up one mark for simply stating that mean, and a standard deviation should be obtained and calculated.

Paper Summary

Based on their performance on this paper, candidates are offered the following advice, as in previous series:

- All nine core practical and all five recommended assessed practical should be thoroughly studied and thought about before the examination, not in it.
- Make sure you thoroughly understand the basic elements of the scientific method as taught at A Level. One variable is varied (the IV), one is measured, as the IV is varied, (theDV) and any other variables which may affect the DV are kept at constant values.
- All command words should also be studied and their usage practiced, again long before sitting in the exam room. A detailed study of past papers, alongside mark schemes and examiners' reports, will be very helpful.

Grade boundaries

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

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