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June 2022

IAL Biology WBI13 01

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June 2022

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Introduction

Despite the difficulties of the last couple of years the entry for this paper was very high and candidates showed a level of performance which was comparable with previous series. This is all the more remarkable in a paper in which performance traditionally tends to benefit from the performance of practical work.

Question 1 (a)(i)

Generally, this item was very well answered, with candidates demonstrating a clear understanding of fertilisation in plants. Very few candidates wrote about the last point on the tissue of the style being digested.

Some responses were not specific enough about what exactly fuses with what.

(a) (i) Explain the role of the pollen tube in plant reproduction.

(3)

- Creates a pathway.
- For male gametes.
- To reach ~~ovule~~ ovary.
- works as a pathway.

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Examiner Comments

This response was awarded 1 mark. It is a very concise and correct answer. However, there is insufficient detail for 3 marks. If the candidate had gone on to say how the pathway was created and what the male gametes were going to the ovary for, 3 marks could have been awarded.

(a) (i) Explain the role of the pollen tube in plant reproduction.

(3)

~~allows to the male gameter to fuse with ovum~~
Transports the male gameter to the ovum & allows double fertilization to occure forming a ~~zygot~~ Triploid zygot

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Examiner Comments

This response was awarded 2 marks. It is a good and concise answer but fails to get all 3 marks due to an error in referring to a triplod zygote.

Question 1 (a)(ii)

This question created a good deal of confusion as many weaker responses failed to identify that a destination was required. Better response gained just the mark detailing the destination. Chemotropism was very scarcely referenced. Weaker response which attempted to discuss a mechanism thought it was gravity driven.

(ii) Explain why pollen tubes grow in the same direction from the stigma, after pollination.

(2)

As the 2 synergids nuclei secreate chemicals that directs the pollen tube nucleus to the ovary through the microphyle.

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Examiner Comments

This response was awarded the full 2 marks.

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Examiner Tip

Five marks on this paper are designed to test candidates' knowledge as part of AO1. This is an example of such a question.

Question 1 (b)(i)

A regular feature of this paper is a question which examines the understanding of types of variable. In this question, candidates were asked about two dependent variables. The majority of response were able to demonstrate good understanding.

(b) The effect of sucrose solutions of different concentrations on the growth of pollen grains was investigated.

The percentage of pollen grains that germinated and the length of the pollen tubes were measured, one hour after they were placed in the sucrose solution.

(i) State **two** dependent variables in this investigation.

(2)

1 Growth rate of pollen grains

2 The length of the pollen tubes

ResultsPlus
Examiner Comments

This response was awarded 1 mark. The two answers are the same, although the first would be derived from the second with division by time.

(b) The effect of sucrose solutions of different concentrations on the growth of pollen grains was investigated.

The percentage of pollen grains that germinated and the length of the pollen tubes were measured, one hour after they were placed in the sucrose solution.

(i) State **two** dependent variables in this investigation.

(2)

1 Number of pollen grains

2 Tempreature

ResultsPlus
Examiner Comments

This response was awarded 1 mark. There are two distinct errors in this response in that the first answer is unfinished by not stating what the number of pollen grains would be doing, and the second answer states a potential confounding variable.

(b) The effect of sucrose solutions of different concentrations on the growth of pollen grains was investigated.

The percentage of pollen grains that germinated and the length of the pollen tubes were measured, one hour after they were placed in the sucrose solution.

(i) State **two** dependent variables in this investigation.

(2)

1 temperature

2 pH

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Examiner Comments

This response was awarded zero marks. The answers state two potential confounding variables.

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Examiner Tip

There are three types of variable you need to be aware of:

- Dependent – the one measured (eg, pollen tube length and percentage germination).
- Independent – the one changed (eg, sucrose solution concentration).
- Confounding – the one that might affect the measurements you make and make your measurements invalid (eg, temperature is one such variable).

Make sure you fully understand all the variables.

Question 1 (b)(ii)

This question was pleasingly well answered. The majority of candidates were able to gain two marks.

(ii) Explain why changes in temperature will affect this investigation.

(2)

Pollen tube uses enzymes to digest its way through the style; therefore, increase in temperature will increase rate of pollen tube growth.

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Examiner Comments

This answer recognises that the temperature effect could be due to the involvement of enzymes in some aspect of the process of pollen grain germination or growth. However, it does not capitalise on this with a bit of detail about *how* enzymes are affected by temperature. It makes the same point throughout and shows a candidate who is not focussed on the fact that this is a two mark question and they need to, therefore, make two distinct points.

Question 1 (c)(i)

The majority of candidates found this question challenging. The weaker responses were able to gain 1 mark by describing the use of the calcium ion solution and the sucrose but lacked further development in the answer. The better responses were given as "*add 2cm^3 of sucrose solution to 8cm^3 of the calcium ion solution*" and were awarded the full 3 marks.

(c) A solution containing calcium ions has to be added to the sucrose solutions.

These solutions were made using:

- a 2.0 mol dm^{-3} sucrose solution
- a solution containing calcium ions and water

(i) Describe how you would make 10 cm^3 of a 0.4 mol dm^{-3} sucrose solution using these two solutions.

(3)

In a test tube add about 1cm^3 of the 2.0 mol dm^{-3} sucrose solution. Adding a solution containing calcium ions and water would dilute the sucrose solution therefore reducing the concentration from 2 mol dm^{-3} to 0.4 mol dm^{-3} and increasing the volume of the two solutions combined.

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Examiner Comments

This response was awarded 1 mark. The candidate starts off with the right idea but gives no useful details of the volumes involved in the case of both solutions.

(c) A solution containing calcium ions has to be added to the sucrose solutions.

These solutions were made using:

- a 2.0 mol dm^{-3} sucrose solution
- a solution containing calcium ions and water

(i) Describe how you would make 10 cm^3 of a 0.4 mol dm^{-3} sucrose solution using these two solutions.

(3)

Dilue the sucrose solution 2.0 mol dm^3 (the biggest solution) with water. find the ratio $C_1 \times V_1 = C_2 \times V_2$ ~~and identify~~

$2 \times V_1 = 0.4 \times 10$ $2X = 4$ $X = 2$ 1:2, 2 is water. ~~to Reduce~~

Calcium is important for the middle lamella to hold cell together as well as important for ATP energy and growth. Place in sucrose solution the in one with Ca ~~to~~ and water and compare results

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Examiner Comments

This response was awarded zero marks. The candidate has misunderstood the question. There is an interesting illustration of the focus but the points about the role of calcium in plants, although having an element of truth, are not relevant to this question.

Question 1 (c)(ii)

The majority of candidates performed well on this question. However, the most common error related to the notion of something that can be controlled by measuring it.

(ii) The calcium ion solution is alkaline.

State how the ~~pH~~ of the sucrose solutions used in this investigation could be adjusted to a required value.

(1)

use of [illegible] ph meter.

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Examiner Comments

This response was awarded zero marks. It is not possible to control or adjust pH by measuring pH.

Question 1 (d)

This was a two-part question with both parts being linked to the final answer. Therefore, it was not possible to comment on the statistics on each.

Candidates found both parts of this question challenging. In part (i) the weaker responses included units in the body of the table, an extra column, incorrect transfer of data and inconsistent use of decimal places.

In part (ii), many candidates were able to gain one mark by recognising that in both the effect of sucrose peaked at 0.4 mol dm^{-3} but they were unable to develop their responses further to gain additional marks.

This question uses the command word, 'comment'. From the specification, comment "*requires the synthesis of a number of factors from data/information to form a judgement* ". Quoting the optimum was a start, but the judgment needed here was about the security of this conclusion. Few responses discussed the limitations of the data obtained.

(i) Draw a suitable table to show the results for percentage germination.

(3)

Sucrose solution / mol dm^{-3}	Percentage Germination (%)
0.0	6
0.2	46
0.4	70
0.8	23
1.6	0

(ii) Comment on the conclusion that both percentage germination and mean pollen tube growth have the same optimum sucrose concentration.

(3)

The graph shows that both of these have the same optimum sucrose concentration, as both the mean pollen tube length and percentage germination graph has initially increased and reached the optimum ~~not~~ sucrose solution at 0.4 mol dm^{-3} and then gradually decreased. It's a non linear graph as slope. When the sucrose solution was 0.4 mol dm^{-3}, the percentage germination was at its highest value 70%, and the mean pollen tube length was also at its highest value at 82 μm. Both of these also reached O~~verall~~ % and 0 μm at 1.6 mol dm^{-3}

(Total for Question 1 = 19 marks)

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Examiner Comments

This is an example of a satisfactory response for part (i) and it was awarded the full 3 marks.

In part (ii) the response was awarded 1 mark for the first marking point.

Overall this response for Q1d was awarded 4 marks.

Question 2 (a)

This question tested candidates' knowledge and understanding of a core practical that they had either undertaken, seen a video of, or read about.

(a) Describe a safe method to observe the stages of mitosis in these roots.

(5)

Wearing gloves ~~and goggles~~ use a sharp blade to carefully cut a small piece of the tip of the root for all concentrations. Variables such as temperature and pH should stay the same for all for the whole experiment and onion species or type. Dip or place the cut root in HCl to soften it, wear gloves as its corrosive. Then stain the sample with methylene blue or acetic orcein so the chromosomes are visible. Then place it between two glass slides and squash it gently so ~~each~~ every cell can be observed. Use a high power microscope to view the chromosomes and count the number of cells in mitosis and the total number of cells. To obtain the mitotic index divide the number of cells in mitosis by the total number of cells. ~~and multiply by 100.~~

ResultsPlus
Examiner Comments

This response was awarded the full 5 marks. The elements of the mark scheme that were identified in this response included: They wore *gloves* , then cut root *tips* , they placed the tips in *acid* , they stained with an *appropriate* stain (in fact naming two, either of which would do), they *squashed* and then viewed under *high power.*

However, this response refers to elements not required of the question, eg, controlling variable. This was not relevant to the answer as the question did not ask for a method for the study to be described, just how mitosis can be observed.

In this response the last three lines are irrelevant as there is no need to refer to counting cells or how to calculate the mitotic index. The question required candidates to provide a description of how to view the stages. Therefore, although the candidate gained full marks, the question was not been read correctly and valuable time was given to including unnecessary information.

(a) Describe a safe method to observe the stages of mitosis in these roots.

(5)

First, wear safety goggles, gloves and labcoat. Then safely cut the roots in small peices and then ~~and place it on a slider.~~ place it on the slider with a few drops of stain to see the cells clearly and cover ~~and~~ slip. Then place it under a light microscope that has been converted or measured correctly. Then observe the stages of mitosis.

ResultsPlus
Examiner Comments

This response was awarded 1 mark. There are some correct elements in this response but the candidate has failed to develop these ideas with detail. The response is awarded a mark for safety, but not for the vague statement of 'safely cut'.

(a) Describe a safe method to observe the stages of mitosis in these roots.

(5)

cut off a peice of the root and place in dish stain root in order for cells to be visable place root cell under microscope. this proceess should be repeated with the root multiple times at diffrent stages of the root/onion growth during the 24. after placing under microscope observe cells throughout ~~throughout~~ throughout each stage ~~which~~ with each sample taken recored results and repeat to ensure accuracy

ResultsPlus
Examiner Comments

This response was awarded zero marks. The reference to a "*piece of root*" is inadequate detail, as is "*stain root*". In addition, *"place root cell under a microscope"* was not worthy of a mark.

However, all these steps are correct features of the method, but the response lacks detail, for example, which part of the root, which stain and exactly how would the microscope be deployed?

This response develops into suggesting repeating and measuring over time, neither of which addresses the question. Furthermore, there is no mention of safety in the response, which was asked for in the question.

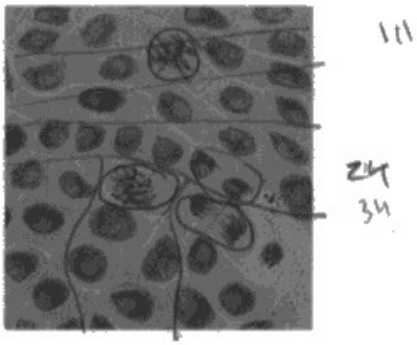
Question 2 (b)

This question was answered well by most candidates. However, there were a number of areas where candidates made mistakes.

Firstly, by counting the cells and then recognising those which are dividing. In order to account for the fact that it was quite hard to count the cells, the mark scheme allowed for a range of possibilities, eg, 35 to 46. There was less latitude for the dividing cells, either 3 or 4.

Secondly, the errors made were in not knowing how to make the calculation of the index and then the mathematics of doing it. This involved making a correct division and then correct rounding, to 2 significant figures, as requested.

(b) The photograph shows part of a root tip from this investigation.



(Source: © Rattiya Thongdumhyu/shutterstock)

Calculate the mitotic index of this root tip.

Give your answer to 2 significant figures.

(2)

MI = number of cells undergoing mitosis / total number of cells

= 4/36 = 0.105 = 0.12

Answer 0.12

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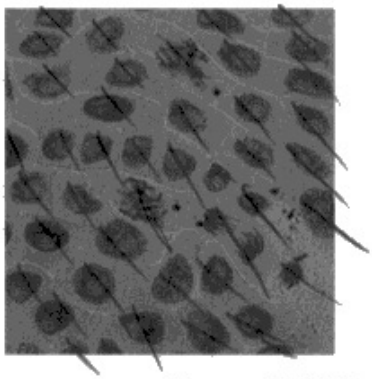
Examiner Comments

This response was awarded 1 mark. Both counts are within the range allowed in both cases. However, the rounding has been incorrectly executed.

ResultsPlus
Examiner Tip

Make sure you are clear about the use of significant figures (A1.1, page 64 in the specification).

(b) The photograph shows part of a root tip from this investigation.



(Source: © Rattiya Thongdumhyu/shutterstock)

Calculate the mitotic index of this root tip.

Give your answer to 2 significant figures.

$\frac{5}{40} \times 100 = 12.5$

(2)

ResultsPlus
Examiner Comments

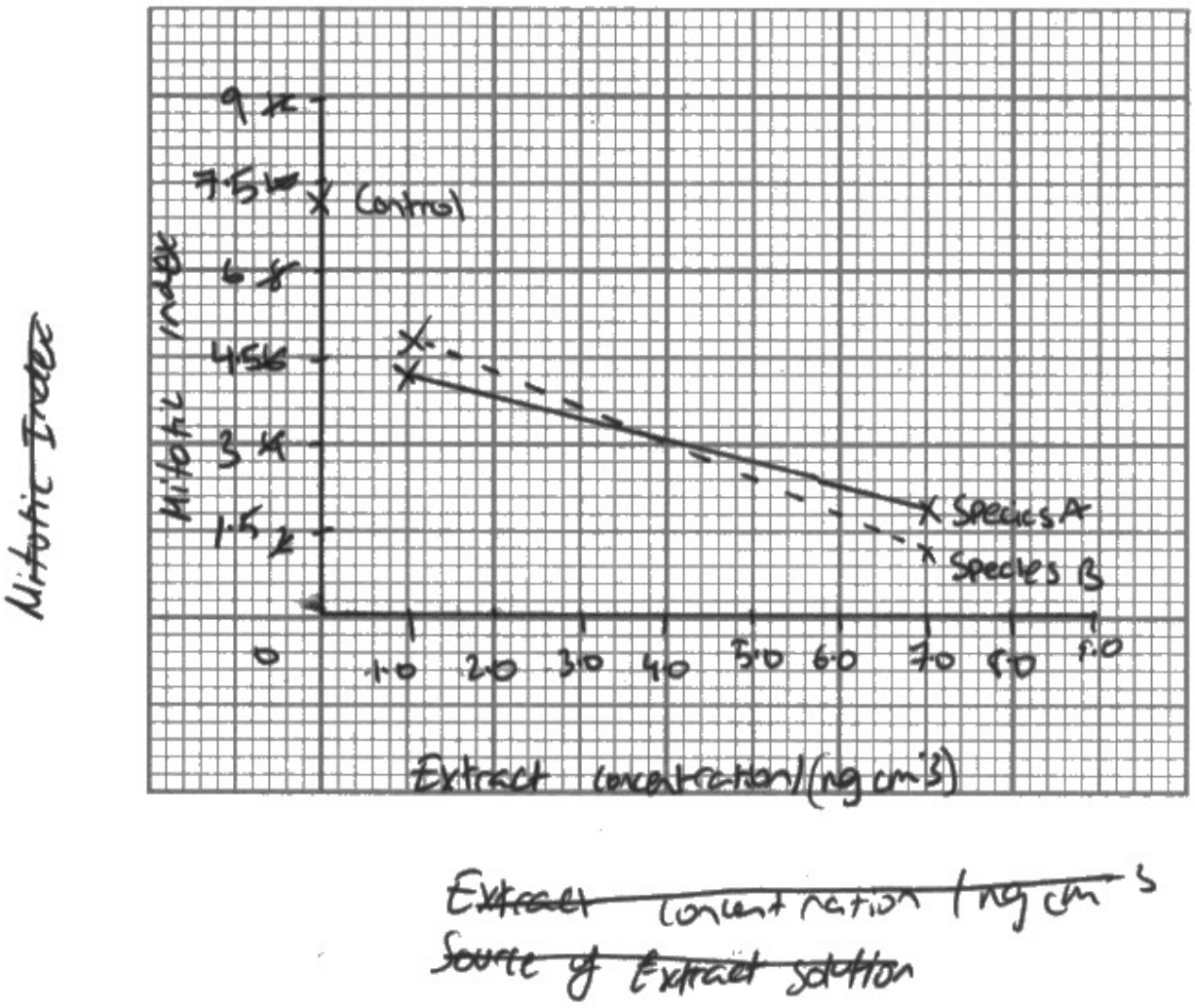
This response was awarded zero marks as there is an incorrect counting of dividing cells.

Question 2 (c)(i)

This was a demanding graph to plot and it was well done by most candidates.

(i) Plot a suitable graph to show the data in the table.

(4)



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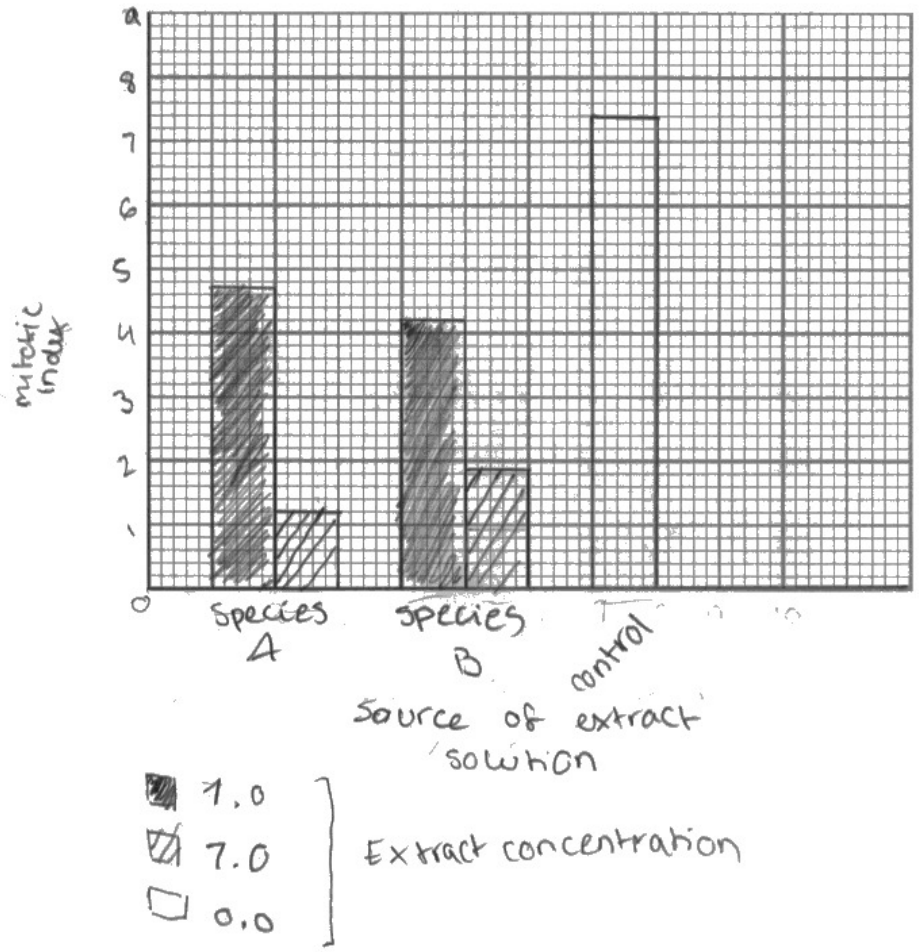
Examiner Comments

This response was awarded 2 marks. Candidates who chose to plot a line graph lost 1 mark. However 3 marks were still available for correctly orientated axes which were properly labelled and with properly plotted points.

(i) Plot a suitable graph to show the data in the table.

(4)



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Examiner Comments

This response was awarded 3 marks. The axes are correctly orientated and the bars correctly plotted. However, it fails to achieve full marks due to inattention to detail. The graph tells us nowhere the units for the extract concentration.

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Examiner Tip

At this level, detail matters. In the case of a graph, make sure that anyone reading your graph will fully understand what it is a graph of.

Question 2 (c)(ii)

This question was testing a procedure which has been tested before on a number of occasions and is fundamental to the development of an understanding of the meaning of data through inferential statistics. It was reasonably well tackled by candidates on this occasion.

(ii) **Describe how this investigation could be modified to determine if the differences between the mitotic indices are significant.**

(4)

Work out the mean of each and Standard deviation. Use a wider range of species of plant.

Use more range of extract concentrations ~~concentrations~~.

Compare with other plant species on same Concentration extract.

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Examiner Comments

This response was awarded 1 mark. The answers given in this response lack detail. The candidate has suggested "*work out the mean and standard deviation*" but without stating where the data for the mean might come from. The remaining answers provide no relevance to the question.

(ii) Describe how this investigation could be modified to determine if the differences between the mitotic indices are significant.

(4)

By repeating multiple times under the same conditions then calculating the SD. Use concentrations of smaller intervals, to see if the differences between intervals of 1.0 are small or larger.

Plot the results against each other in scatter graph to compare

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Examiner Comments

This response was awarded 3 marks for its reference to "*repeating*" under the "*same conditions*" and calculating the "*standard deviation*". Unfortunately, the response does not go on to say what these standard deviations might tell us.

(ii) Describe how this investigation could be modified to determine if the differences between the mitotic indices are significant.

(4)

The experiment should be repeated with different concentrations of the extract for each species A and B. The experiment should be repeated 3 times to ensure an accurate value for mitotic index is calculated. The experiment could be repeated with different lengths of the onion root tips. The results can be compared to the mitotic index of another vegetable with root tips such as a carrot.

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Examiner Comments

This response was awarded 1 mark. When asked to comment on modifying an experiment, candidates often resort to suggesting that various things should be 'repeated' and then go on to suggest incorrect reasons as to how this might help. In this response, the suggestion is valid for one mark, but the circumstances in which the repeats should be done, the reason for doing them and the consequences of the results are not given or correct.

Question 3 (a)

Overall, candidates found this question very challenging. The better responses gave a very detailed account of how to carry out a serial dilution. Of course, this is relevant to the question but more is needed to answer the question fully.

(a) Describe how the data in the table could have been obtained using a 1% starch solution.

(4)

Using 1% starch solution the ratio between ~~wat~~ volume of water and strach should be measured. For a 0.1% concentration, 9 ml of water should be used with 1 ml of the 1% starch solution. The 0.01% solution could be obtained by adding 1 ml of the 0.1% concentration made previously and 9 ml worth of water. The 0.001 could be made using ~~the prev~~ 1ml of the previous 0.01% concentration of solution to 9 ml of water. The rest is made that way.

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Examiner Comments

This response was awarded 1 mark for the first marking point.

(a) Describe how the data in the table could have been obtained using a 1% starch solution.

(4)

different concentrations were obtained by dilution of 1% starch solution with distilled water to form starch solutions with lower concentrations. the lower the concentration the lighter the colour of solution after addition of iodine solution.

amount of 1% starch concentration needed (ml)	starch concentration
100 %	1.0
10 %	0.1
1 %	0.01
0.1 %	0.001
0.01 %	0.0001

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Examiner Comments

This response was awarded zero marks. The candidate has presented some basic ideas, such as dilute the stock, add iodine, and there is some reference to colour. However, none of this would allow any data, as given in the table, to be obtained. Furthermore, there is no detail in this response.

Question 3 (b)

Overall, candidate found this question very challenging and only a few were able to gain all four marks. This question demonstrations candidates' failure to take into consideration the number of marks available and not crafting their answers to take this into account.

(b) The table shows the results for the four potato varieties.

Potato variety	Colour
King Edward	black
Nicola	very pale blue
Purple Congo	pale blue
Russet	dark blue

Discuss the extent to which these results support the suggestions about the use of these potato varieties.

(4)

Firstly, the king Edward potato turns iodine black which does indicate a high starch concentration of ~~>0.1~~ 1.0% so the suggestion of it being good for baking is correct. The Russet potato turns dark blue which means it has a starch concentration of ~ 0.1% which is still high & good for baking, but less good than King Edward. Meanwhile, the Nicola potato has a starch conc. of ~~0.01~~ 0.005% and the Purple Congo of around 0.01% which makes them both have a low starch concentration, but the Nicola potato is better for boiling than the purple Congo. The results mostly support the suggestions with the king Edward potato being the best for baking & the Nicola potato being best for boiling.

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Examiner Comments

This response was awarded the full 4 marks by making an overall conclusion that the data supports the suggestions. In addition, the response assesses the suitability of two potatoes for baking and two for boiling with reasons. The response also compares the baking and boiling qualities within each variety.

(b) The table shows the results for the four potato varieties.

Potato variety	Colour
King Edward	black
Nicola	very pale blue
Purple Congo	pale blue
Russet	dark blue

Discuss the extent to which these results support the suggestions about the use of these potato varieties.

(4)

True as Nicola contains 0.001 starch concentration and Purple Congo contains 0.01 starch concentration so they have low starch contents while King Edward contains 1.0 starch concentration and Russet contains 0.1 starch concentration so they have high starch content

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Examiner Comments

This response was awarded 1 mark for the word 'true' at the beginning. However, the candidate does not develop this idea further by stating why it is true.

The candidate makes correct conclusions about the starch concentrations but does not link this to the suggested suitability of these potato varieties for different roles.

Question 3 (c)

Candidates found this question very challenging. Very few responses were awarded the full 2 marks.

(c) Suggest how this investigation could be adapted to produce quantitative data.

(2) 1-2

Quantitative data can be obtained by assigning numerical value to the colours shown by the starch solution. For example, on a scale of 1-10, 10 would indicate iodine solution turning black and 1 ~~colourless~~ would indicate the iodine solution being a pale brown

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Examiner Comments

This response was awarded zero marks. The method proposed in this response would not give quantitative data.

(c) Suggest how this investigation could be adapted to produce quantitative data.

(2)

use a colorimeter to record the absorbance of the different solutions. The higher the value, the greater the concentration of starch.

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Examiner Comments

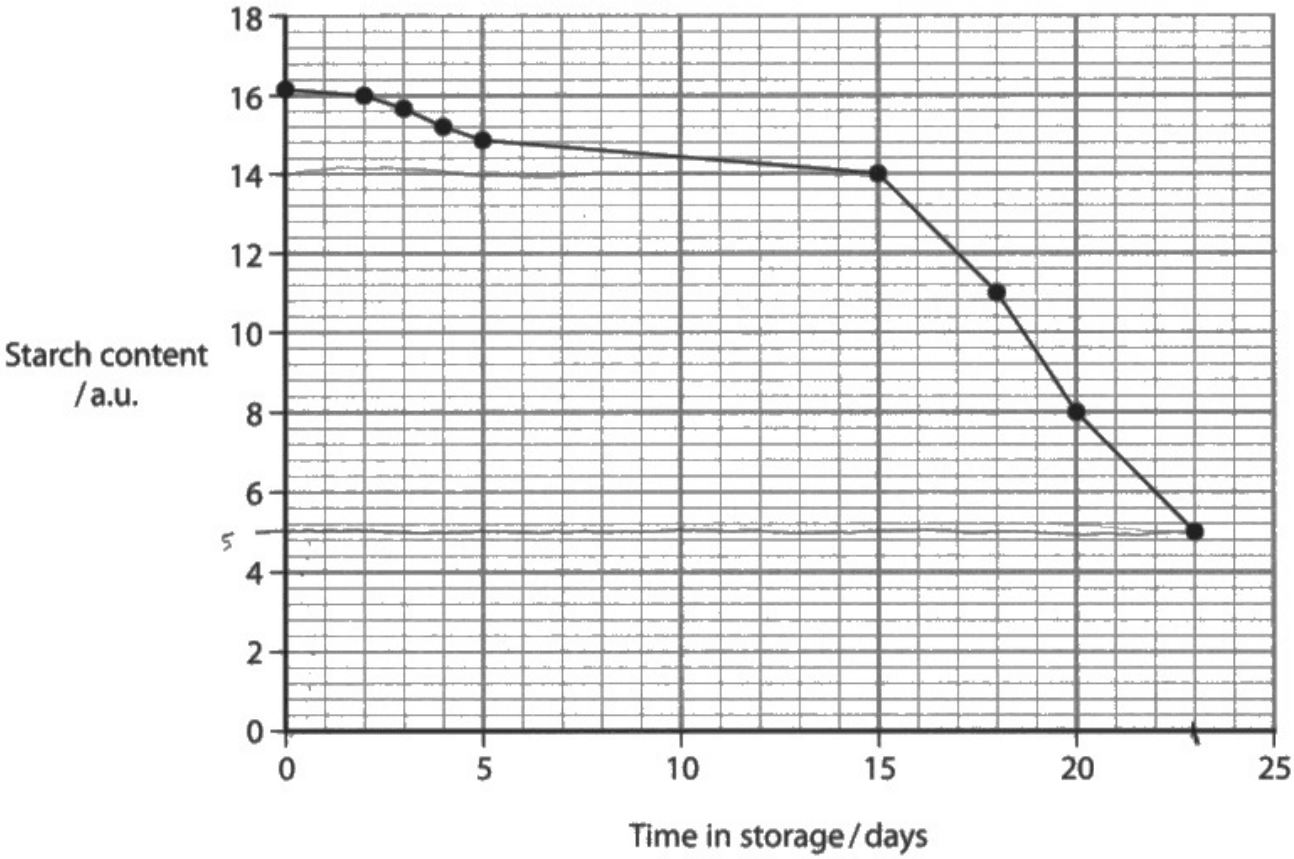
This is an example of a response that was awarded the full 2 marks. In one sentence there are two marks for the use of a *colorimeter* to measure *absorbance*.

Question 3 (d)(i)

This question was a good differentiator. Candidates were awarded marks across the whole range of available points.

(d) It is suggested that the change in the taste and consistency of stored bananas is due to changes in their starch content.

An investigation of the content of starch in stored bananas produced the following results.



(i) Calculate the rate of decrease in starch content from day 15 to day 23.

Include units in your answer.

(2)

$$\frac{14 - 5}{14} \times 100 = 64.3\%$$

Answer 64.3%

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Examiner Comments

This response was awarded 1 mark for correctly reading off the graph and then carrying out the correct workings with the numbers obtained. However, the candidate fails to understand what is meant by 'rate' and calculates the answer incorrectly.

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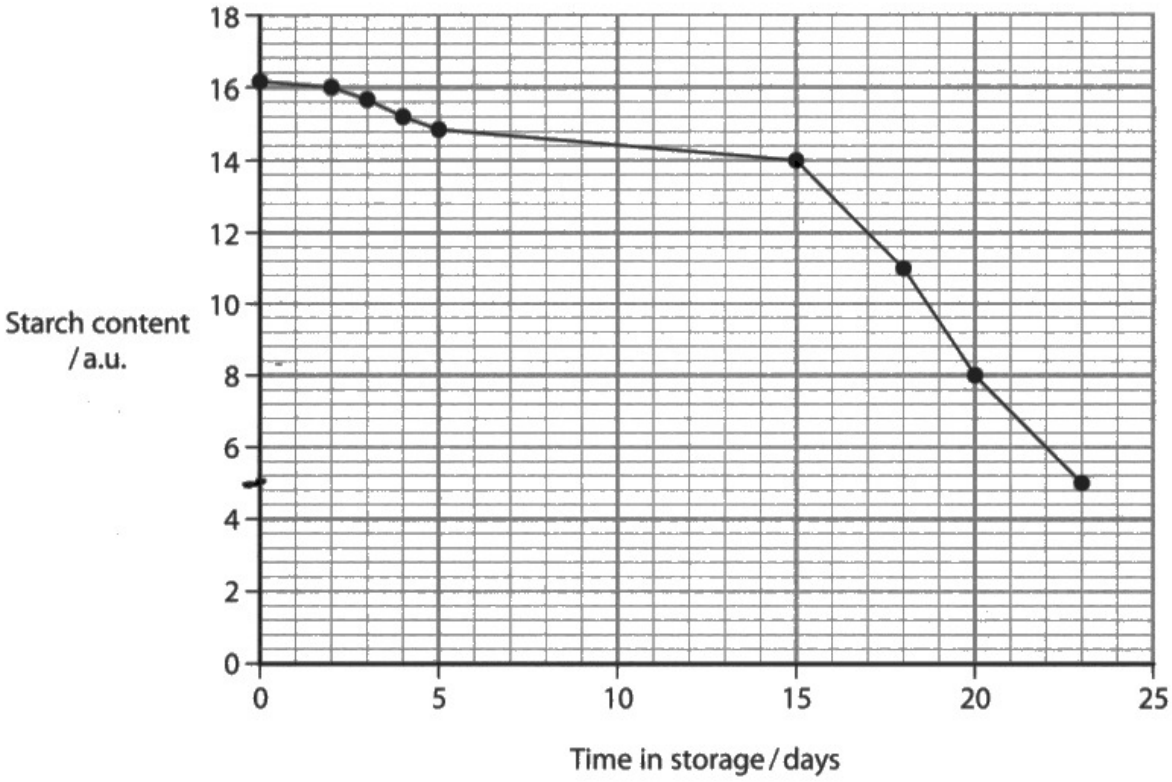
Examiner Tip

Check through the mathematics requirements in the specification (pages 62-67) and learn how to carry out all of the required operations. About 10% of the marks are devoted to testing mathematical skills.

(d) It is suggested that the change in the taste and consistency of stored bananas is due to changes in their starch content.

An investigation of the content of starch in stored bananas produced the following results.



(i) Calculate the rate of decrease in starch content from day 15 to day 23.

Include units in your answer.

~~15~~ 23 - 15

(2)

14 - 5 = 9

$\frac{9}{8}$ = 1.125

Answer 1.125

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Examiner Comments

This response was awarded 1 mark. The candidate carried out the calculation correctly but lost a mark for not following the instruction to "*include units in your answer*".

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Examiner Tip

Always read the question carefully. It has been precisely worded to elicit a particular response.

Question 3 (d)(ii)

This is a standard data description question and it was well answered by the majority of candidates.

(ii) Describe the changes in starch content during the 23 days of this investigation.

(2)

- The ~~conc~~ starch content decreases as the number of days increases (negative correlation).
- non-linear

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Examiner Comments

This response was awarded 1 mark. The candidate has provided a correct answer but this is a two-mark question and the candidate has only given one point.

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Examiner Tip

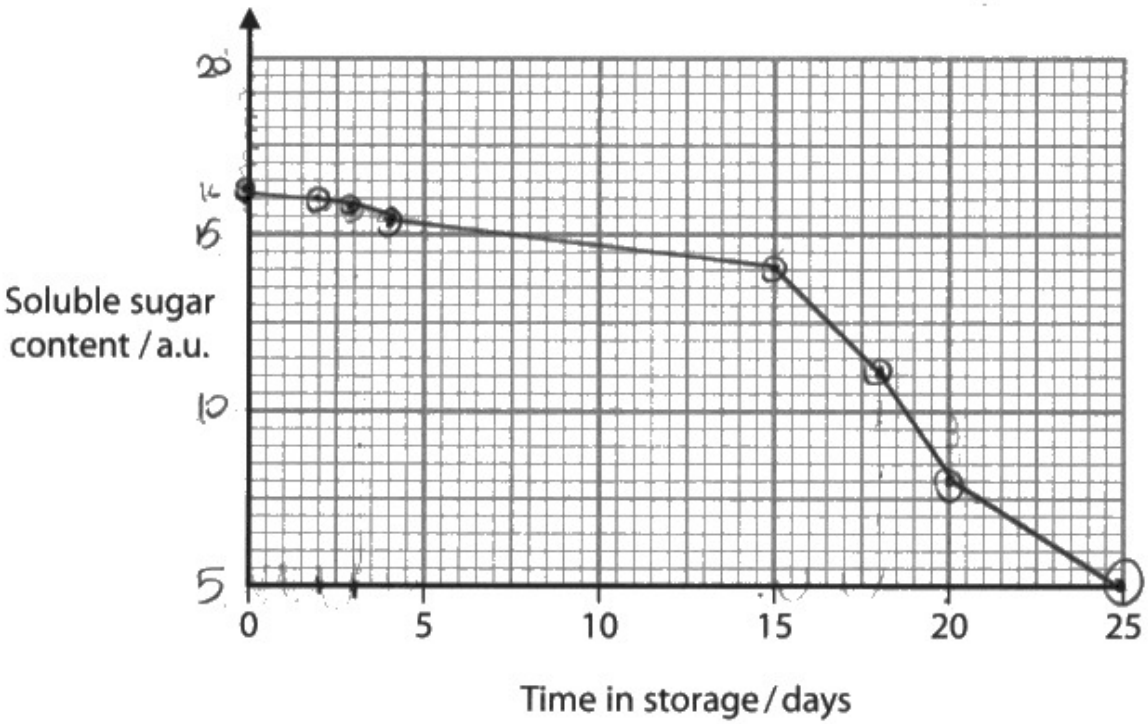
Always try to craft your answer in terms of the number of marks available.

Question 3 (d)(iii)

This question style was a new departure and performance was rather mixed.

(iii) Sketch a graph to show the soluble sugar content of these bananas during storage.

(2)



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Examiner Comments

This response was awarded zero marks as the biology has not been understood. If starch levels fall over time then sugar levels will almost certainly rise, unless all the sugar is instantly used.

Any response which showed a rise in sugar levels would gain 1 mark. Conversely, any response which showed a fall demonstrated a lack of understanding of the biology and would not be creditworthy.

Paper Summary

This is the tenth series of this qualification since the new syllabus started in 2018.

With the addition of the Sample Assessment Material (SAM), there are now 11 sets of 3 questions as practice papers available on the qualification page of the Pearson website.

The key to translating 2 years of learning into examination marks is to practise past papers. The same general principles are examined every time so this practise will benefit students in their preparation for the examination.

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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