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Examiners' Report
June 2012

GCE Biology 6BI02 01

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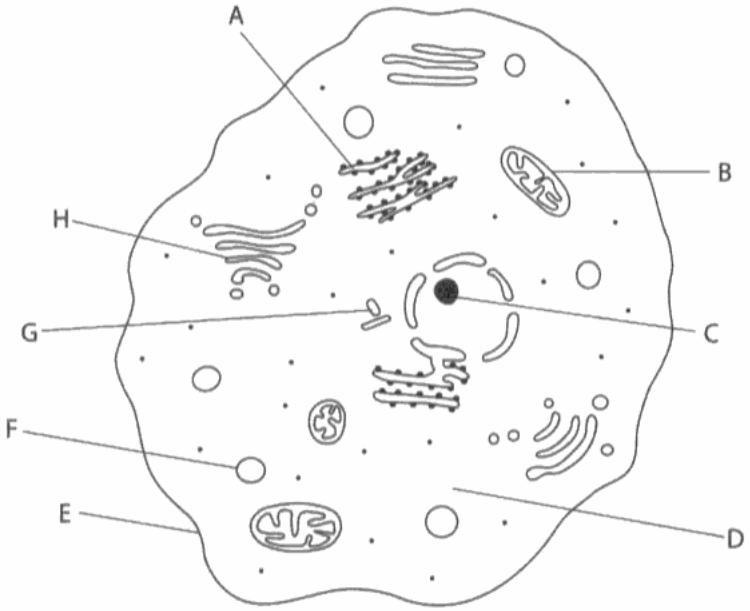
Introduction

There were some very good responses seen to all the questions set in this summer's paper, demonstrating accuracy and appropriate levels of detail. However, poor communication skills, particularly with regard to clarity of expression, cost many candidates marks. Knowledge of the topics covered in this exam was generally good, especially with regard to the process of protein synthesis and the structure of gametes; however, poor spelling of vital vocabulary and lack of depth in descriptions was also evident. Questions on concepts such as double fertilisation or experimental procedure proved to discriminate between those with a sound understanding of the subject matter and those with only a superficial grasp of the AS course. Consequently, this paper did result in a wide range of total scores, reflecting the range in aptitude of the candidates, not only in Biology, but in their ability to write clearly in examination situations.

Question 1 (a)

The majority of candidates were able to identify the structures on the drawing; virtually all correctly identified the rER and mitochondrion. The spelling of nucleus and nucleolus were critical to success; a good few candidates fell at this hurdle, writing 'nucleous' which was marked as incorrect.



(a) Name the organelles labelled A, B and C shown on the diagram.

(3)

A RER Rough endoplasmic reticulum.

B Mitochondria

C Nucleus.

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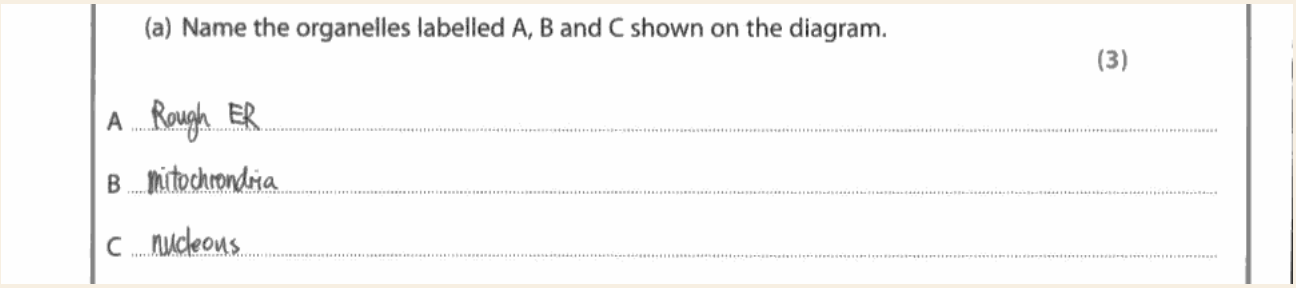
Examiner Comments

This candidate has made sure of the first mark by writing RER and the full name of the organelle - RER on its own would have gained the mark here.


(a) Name the organelles labelled A, B and C shown on the diagram.

(3)

A Rough ER

B Mitochrondria

C nucleous

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Examiner Comments

Rough ER is sufficient for the mark - endoplasmic reticulum on its own would not have been.

Common mistake for C - nucleous - frequently seen and not awarded a mark.

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Examiner Tip

Learn how to spell biological terms such as nucleus and nucleolus - they are different things and mixing up the two words is not going to gain any marks.

Question 1 (b)

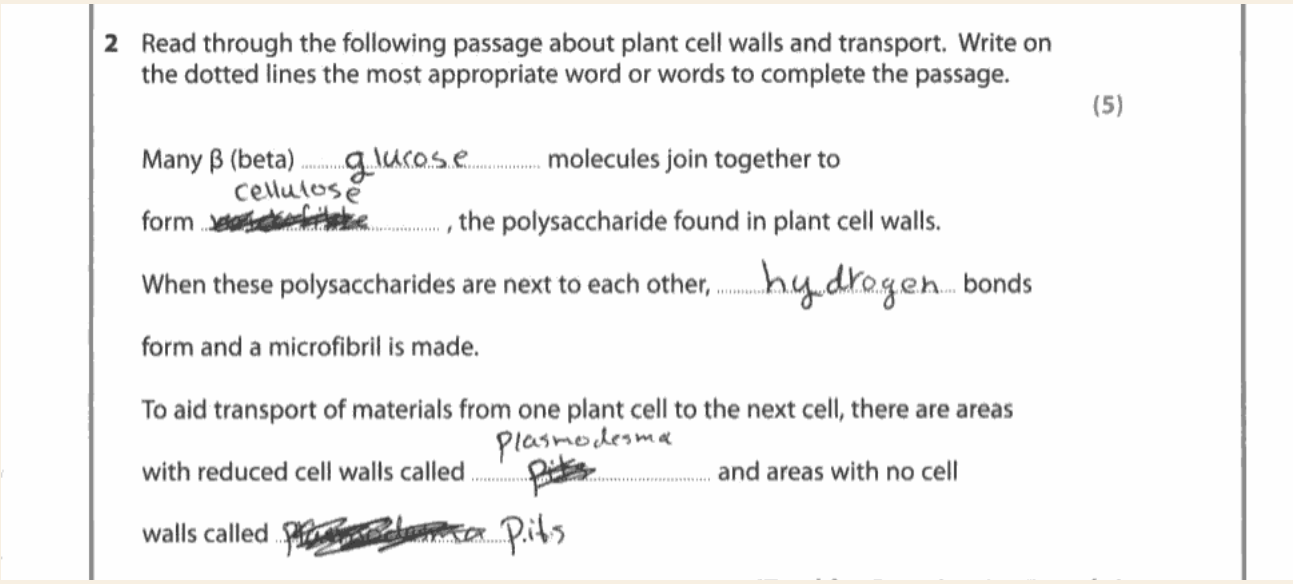
The main error made here was giving the name of the organelle instead of the letter. Care must be taken to follow the instructions in questions.

Question 1 (c)

As with 1b, the main mistake made here was writing the name of the organelle instead of the letter. The aim of this question was to test that candidates could identify, from a diagram, organelles from descriptions of how they behave during cell division.

Question 2

This type of question often appears relatively easy, but candidates lose marks as a result of failing to read through the whole passage and guessing instead of deducting which words should go in the gaps. Many students gained all available marks; others gave glycosidic instead of hydrogen bonds because they associated them with polysaccharides. Virtually all candidates gained the first mark, and most the next two, although pits and plasmodesmata were frequently the wrong way round if known at all.



2 Read through the following passage about plant cell walls and transport. Write on the dotted lines the most appropriate word or words to complete the passage.

(5)

Many β (beta) ..glucose.. molecules join together to form ..cellulose.. , the polysaccharide found in plant cell walls.

When these polysaccharides are next to each other, ..hydrogen.. bonds form and a microfibril is made.

To aid transport of materials from one plant cell to the next cell, there are areas with reduced cell walls called ..Plasmodesma Pits.. and areas with no cell walls called ..Pits..

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Examiner Comments

This candidate got 3/5 marks. If they had thought carefully before switiching pits and plasmodesmata they could have gained all 5.

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Examiner Tip

Think before changing your answers - panic can lead to correct answers being crossed out.

2 Read through the following passage about plant cell walls and transport. Write on the dotted lines the most appropriate word or words to complete the passage.

(5)

Many β (beta) glucose molecules join together to form ~~microfibrils~~ carbohydrates 1-4 glycosidic chains, the polysaccharide found in plant cell walls.

When these polysaccharides are next to each other, hydrogen bonds form and a microfibril is made.

To aid transport of materials from one plant cell to the next cell, there are areas with reduced cell walls called ~~plasmodesmata~~ pits and areas with no cell walls called plasmodesmata.

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Examiner Comments

This candidate has not read the entire sentence before guessing what to put in the second blank space. They have tried 'carbohydrates', 'microfibrils' and settled for '1-4 glycosidic chains' - all of which are wrong. The polysaccharide found in plant cell walls is cellulose - something all AS Biology candidates should know.

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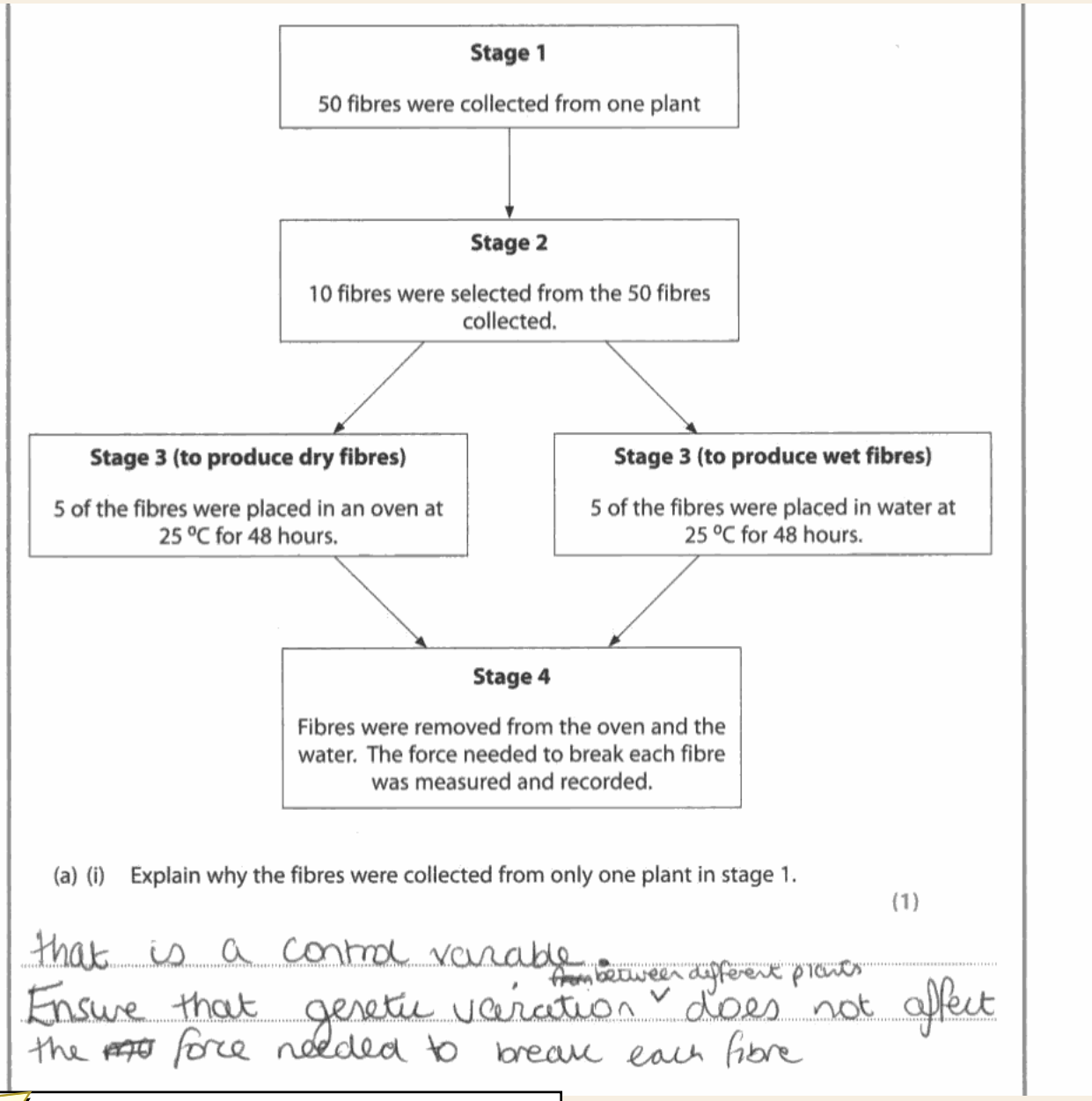
Examiner Tip

Read through the whole passage before filling in the gaps -don't just put in the first word that comes to mind. Read the context and then put in words that completes the sentences sensibly!

Question 3 (a) (i)

All three marking points were seen, but sometimes the mark was lost for stating 'reduced genetic variation', when clearly there should be 'no… variation'. There were also numerous unqualified references to a 'fair test', an inadequately vague response at this level. Too many answers explained why different plants were **not** used and fewer why the same plant was used.



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Examiner Comments

This response begins with a confused statement - a 'control variable' being a cross between a 'control' and a 'controlled variable' which are two different things. A control allows for comparisons to be made and a controlled variable ensures that results are reliable. This example gains the mark for making it clear that the reason for using fibres from the same plant was to 'ensure ...genetic variation between different plants does not affect' the results.

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Examiner Tip

This candidate has added a statement to make their answer clearer - if you think you can do this, do it! It can help the examiner work out what you actually mean and can make the difference between getting the mark or not getting it.

(a) (i) Explain why the fibres were collected from only one plant in stage 1.

(1)

To reduce variation. Make sure all fibres were identical (or as close to identical as possible), so that results would be comparable. All fibres are genetically identical. Only environmental influences varying.

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Examiner Comments

The first statement does not gain a mark - it is too vague. Making the fibres identical is also insufficient for the mark. However, the mark was given for 'genetically identical' - especially as the candidate makes it clear that the reason is to make sure only environmental factors vary.

(a) (i) Explain why the fibres were collected from only one plant in stage 1.

(1)

To ensure all fibres were grown under the same conditions

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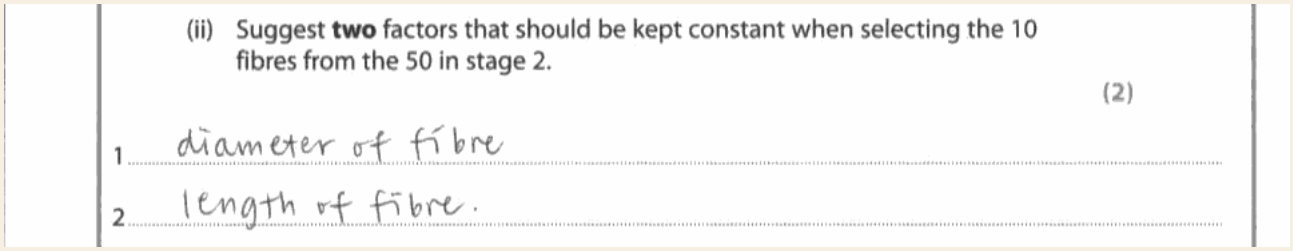
Examiner Comments

This is an alternative, but also acceptable, answer.

Question 3 (a) (ii)

Most candidates were able to score two marks, although occasionally the word "size" was used to describe an aspect of the fibre. However, there were examples where it appeared students had not read the second half of the question and started stating general factors such as room temperature and humidity. For most this was straightforward; many clearly drew on experience of similar experiments.



(ii) Suggest **two** factors that should be kept constant when selecting the 10 fibres from the 50 in stage 2.

(2)

1 diameter of fibre

2 length of fibre.

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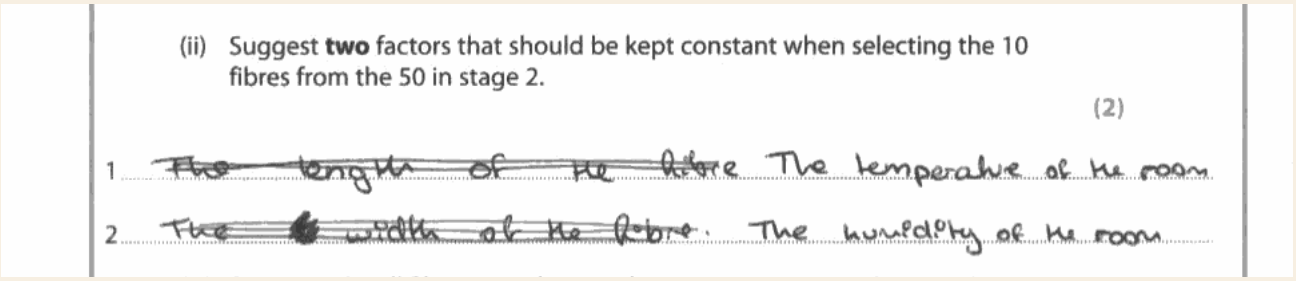
Examiner Comments

A nice clear answer - sticking to one factor per line!



(ii) Suggest **two** factors that should be kept constant when selecting the 10 fibres from the 50 in stage 2.

(2)

1 ~~The length of the fibre~~ The temperature of the room

2 ~~The width of the fibre~~. The humidity of the room

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Examiner Comments

Unfortunately this candidate has crossed out two correct responses and replaced them with incorrect answers. These two factors would need to be kept the same when carrying out the investigation - but they are not factors to be kept constant when 'selecting the 10 fibres'.

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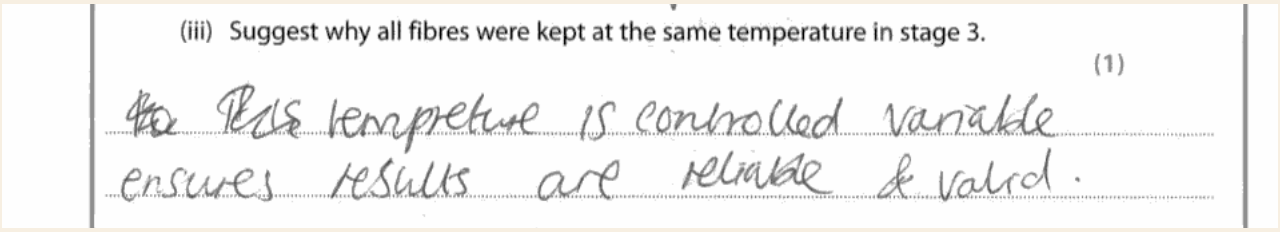
Examiner Tip

Always check the context of the question - it is vital for achieving full marks.

Question 3 (a) (iii)

Poor grammar sometimes made it difficult to understand the point that was being made by the candidates, although many were able to make the point that temperature is, itself, a variable. Again many answers dealt with reasons the fibres were not kept at different temperatures, rather than reasons for keeping them at the same temperature.


(iii) Suggest why all fibres were kept at the same temperature in stage 3.

(1)

the temperature is controlled variable ensures results are reliable & valid.

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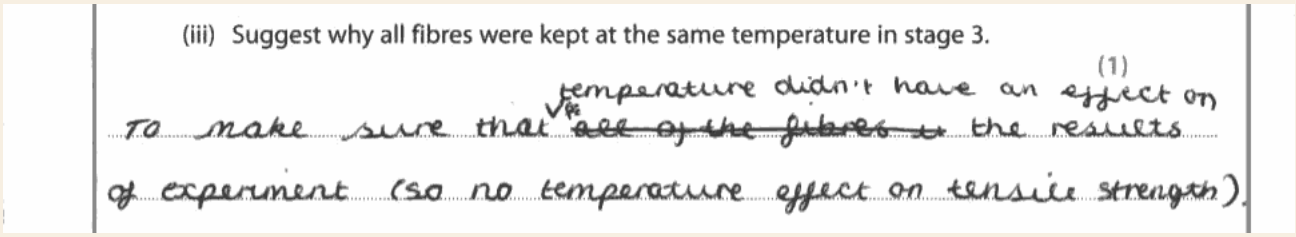
Examiner Comments

Good, clear answer - makes it clear that the candidate knows that temperature has to be a controlled variable, necessary for producing reliable results.


(iii) Suggest why all fibres were kept at the same temperature in stage 3.

(1)

To make sure that temperature didn't have an effect on ~~the rate of the fibres~~ the results of experiment (so no temperature effect on tensile strength).

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Examiner Comments

Another example of a good answer, clearly recognising the need to make sure temperature did not affect the strength of the fibres or the results.

Question 3 (b)

The vast majority realised that there were aspects to the investigation that could cause damage to the eyes which accounted for the need to wear safety goggles.

Question 3 (c) (i)

Most correctly stated that greater force was needed to break the wet fibres, but fewer were able to back it up with correctly calculated evidence with units. A few didn't pay attention to the word 'mean' in the question and compared other values in the table.

(c) The table below shows the results of this investigation.

Sample	Force needed to break each fibre / arbitrary units	
	Wet	Dry
1	4200	2800
2	3800	2900
3	4100	2600
4	4100	2700
5	3100	2800
Mean	3860	2760

(i) Compare the mean force needed to break the wet fibres with the mean force needed to break the dry fibres.

(2)

The mean force needed to break the wet fibre is higher ~~than~~ (greater) than mean force needed to break dry fibre. ~~It~~ It is larger by 1100 arbitrary units

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Examiner Comments

This candidate gains the first mark easily - stating clearly that the **mean** force need to break the wet fibres is higher/greater. Then the second mark is also awarded for correctly calculating the difference and giving units.

(i) Compare the mean force needed to break the wet fibres with the mean force needed to break the dry fibres.

(2)

The mean force needed to break the wet fibres is over 1000 arbitary units greater than the mean force needed to break the dry fibres. For the wet fibres, the mean force was 3860 arbitary units, but for the dry fibres it was 2760 arbitary units

(ii) State which of these two sets of data is less reliable. Give reasons for your

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Examiner Comments

Although this answer gains the first mark, that is all it gets. This is an example of where someone has quoted the figures from the table but then failed to do anything else with them. A vague statement of 'over 1000 arbitrary units' is not good enough - not when a simple subtraction gives 1100 au.

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Examiner Tip

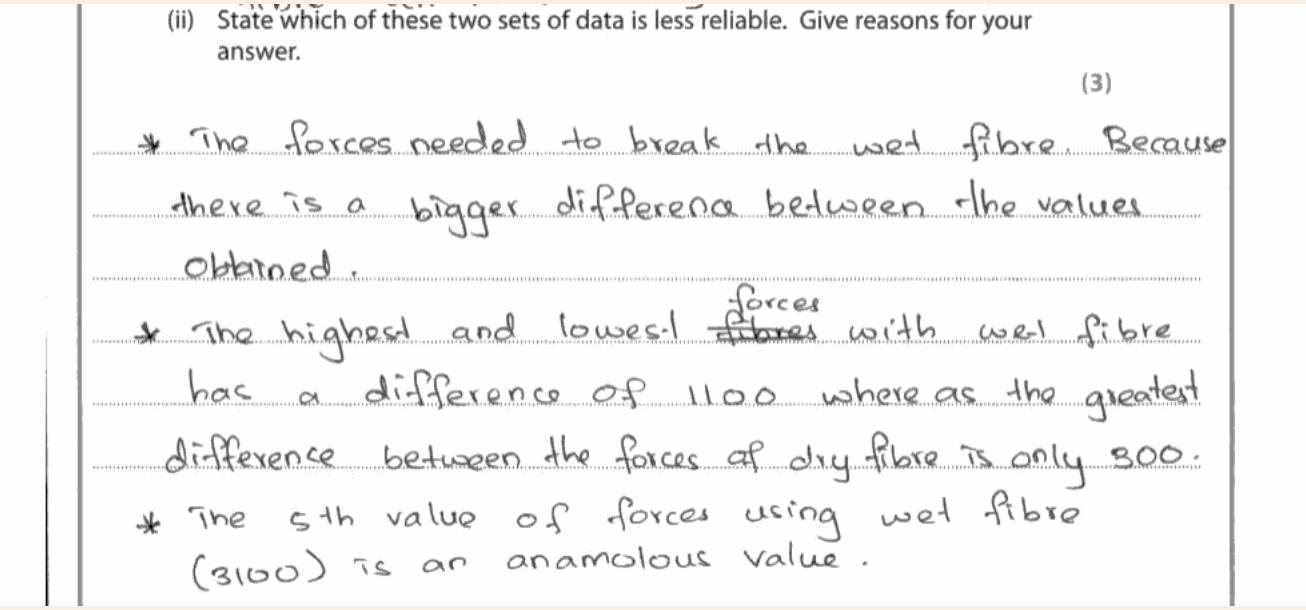
It is always a good idea to underline key words and figures from tables - which this candidate has done.

Question 3 (c) (ii)

This question was generally well understood. However, a few thought they had to name the 'samples' that were unreliable rather than the 'set'. Most gained 2/3 marks, but others noticed the anomalous result and stopped there, not realising that it was not enough for three marks. Most candidates understood the concept of a wide range showing unreliability but many had difficulty expressing their ideas clearly, the most common error was for candidates to refer to 'higher' or 'lower' range rather than 'wider or 'narrower'. Some also incorrectly described variation in data rather than range, whereas both sets of data had the same variation, 4 different values for each. Many candidates quoted figures from the data without any manipulation and appeared to assume that this was the same as stating which was larger.

There were also mistakes made with basic subtraction, many giving incorrect figures for ranges of 1000 for wet fibres and/or 200 for the dry fibres. Many were quite proficient at using the term anomaly, or outlier, but didn't always link this to the value 3100 or sample 5.

Some students remarked on the absorption of water by the fibres and the inaccuracies this would result in, describing reasons for the unreliability of the data, rather than reasons for selecting a particular set as unreliable.



(ii) State which of these two sets of data is less reliable. Give reasons for your answer.

(3)

* The forces needed to break the wet fibre. Because there is a bigger difference between the values obtained.
* The highest and lowest ~~fibres~~ forces with wet fibre has a difference of 1100 where as the greatest difference between the forces of dry fibre is only 800.
* The 5th value of forces using wet fibre (3100) is an anamolous value.

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Examiner Comments

This gains 3 marks - the first mark for wet fibres, the second for noting the difference in range, the third for calculating the relative ranges. This candidate also clearly described the anomaly at 3100 for the 5th wet fibre value.

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Examiner Tip

Check how many marks are available - in this case there were 3 - that gives you an idea of how many points need to be made. This candidate has separated the points which helps set out the answer.

(ii) State which of these two sets of data is less reliable. Give reasons for your answer.

(3)

The data for the Wet fibres. Because the range ~~of~~ from maximum force ~~see~~ to minimum force was 1100 arbitrary units, whereas in dry fibre the range from ~~maxim~~ maximum force to minimum force was 300 arbitrary units. The data for the wet fibres is less precise so hense less reliable.

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Examiner Comments

This answer gets 2 marks - one for identifying the 'wet fibre' set of data as less reliable and one for correct calculation of the ranges for each. However, it does not state that the range for the wet fibres was more than that for dry fibres. The wider range does not necessarily mean the data was 'less precise'- that would be a consequence of the equipment used to make the measurements.

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Examiner Tip

Remember - the obvious must be stated, examiners cannot give marks for something that has not been written.

(ii) State which of these two sets of data is less reliable. Give reasons for your answer.

(3)

Wet fibres are less reliable. because the water ~~soaked~~ in the fibres may alter the results, as energy will be needed more to break.

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Examiner Comments

This response only gets one mark - for stating that the wet fibre data is less reliable. However, this answer then tries to explain why the data would be less reliable, instead of giving reasons for selecting that set as the least reliable.

Question 3 (d) (i)

Unfortunately this was poorly attempted, with many vague answers, this question required careful study of the data. Many stated that '3, 4 and 5 were lower than 1 and 2', despite the fact that the value for sample 5 was the same as that for sample 1. Few were able to analyse the results to answer this question correctly, those that did gave simple, concise answers.

(d) A student observed that dry fibres 3, 4 and 5 each had a knot in the middle of their length and that they broke at the knot. She used this observation to state that the recorded force needed to break these three dry fibres was an underestimate.

(i) Suggest **one** piece of evidence from the table that supports her statement.

(1)

fibres 3 and 4 are lower in breaking value than 1 and 2 which have no ~~knots~~ Knots

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Examiner Comments

This gets the mark for clearly stating that 3 and 4 break at lower values than 1 and 2, which have no knots.

(d) A student observed that dry fibres 3, 4 and 5 each had a knot in the middle of their length and that they broke at the knot. She used this observation to state that the recorded force needed to break these three dry fibres was an underestimate.

(i) Suggest **one** piece of evidence from the table that supports her statement.

(1)

One [redacted] piece of evidence is that sample 1 and 2 in the dry condition took more force to break than 3, 4, 5.

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Examiner Comments

This answer does not get the mark because it states that 1 and 2 took more force to break than '3, 4, and 5'.

(d) A student observed that dry fibres 3, 4 and 5 each had a knot in the middle of their length and that they broke at the knot. She used this observation to state that the recorded force needed to break these three dry fibres was an underestimate.

(i) Suggest **one** piece of evidence from the table that supports her statement.

(1)

The dry results for fibres 3, 4 ~~and 5~~ were lower than the results for dry fibres 1 and 2

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Examiner Comments

This answer shows evidence of the candidate having checked what they've written and crossed out '5' - this has saved them the mark.

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Examiner Tip

It always pays to check what you've written.

Question 3 (d) (ii)

Many were able to answer this simple question correctly. However, a surprising number of candidates thought that the sequence in the table, samples 1-5, had some significance and looked for increases or decreases in the force down the table.

(ii) Suggest **one** piece of evidence from the table that does **not** support her statement.

(1)

The fact that fibre 5 had the same force need to break it as fibre 1 which did not have a knot in its length.

(Total for Question 3 = 12 marks)

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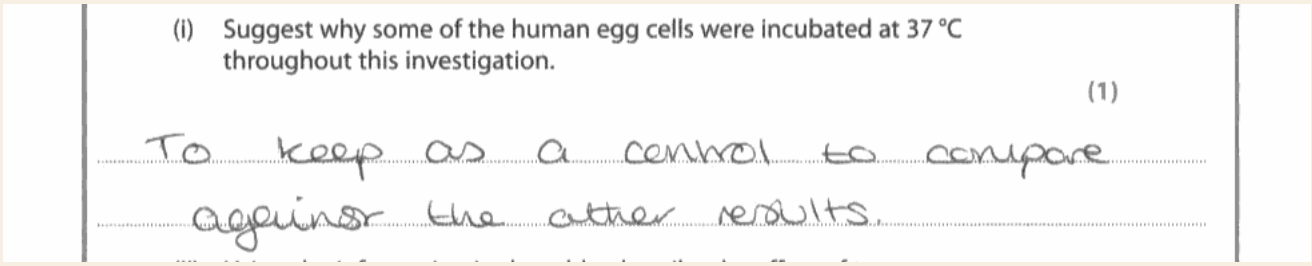
Examiner Comments

This is typical of the answers given to this question - for some reason it proved easier for candidates than 3di.

Question 4 (a) (i)

Many candidates made reference to human body temperature, but only some made reference to a control. Good answers did describe the reason for having a control for comparison. It's essential that candidates appreciate the difference between a 'control' and a 'controlled variable'.



(i) Suggest why some of the human egg cells were incubated at 37 °C throughout this investigation.

(1)

To keep as a control to compare against the other results.

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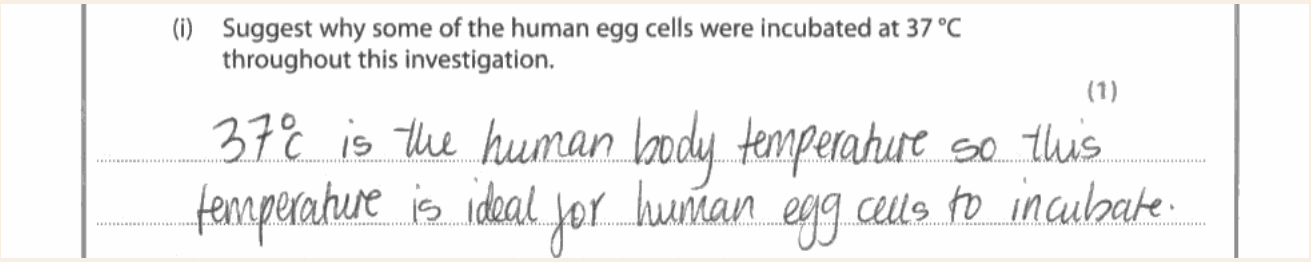
Examiner Comments

Straightforward answer clearly stating the purpose of incubating some of the egg cells at 37°C throughout.



(i) Suggest why some of the human egg cells were incubated at 37 °C throughout this investigation.

(1)

37°C is the human body temperature so this temperature is ideal for human egg cells to incubate.

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Examiner Comments

A typical incorrect response stating that 37°C is human body temperature. This does not answer the question - all of the egg cells were returned to 37°C, but only some were kept at this temperature throughout.

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Examiner Tip

Read **all** of the question - many answered this as if they'd only read the first line and were answering the question: 'Suggest why some of the egg cells were incubated at 37°C'.

Question 4 (a) (ii)

Candidates had difficulty expressing themselves when answering this question, a straightforward question requesting a description of data from a table. Many simply indicated that there was positive correlation between temperature and numbers of cells showing spindle fibre formation, without giving a ceiling of 33°C, although a large proportion noted that there was no change at temperatures above 33 °C. Few candidates managed to show sufficient distinction between spindle fibre formation at different temperatures and the number of egg cells showing spindle fibre formation to achieve any marks; this appeared to indicate a lack of knowledge of the process of nuclear division. A large number of candidates simply quoted figures from the table rather than actually interpreting them to describe a trend. Some did a partial calculation, but did not state 'x degree rise in temperature caused y increase in cells showing spindle fibre formation'.

(ii) Using the information in the table, describe the effect of temperature on spindle fibre formation in human egg cells.

(2)

As the temperature increases from 25°C to 33°C spindle fibre formation in egg cells increases, giving a positive correlation. An increase of 5°C when going from 28°C to 33°C increases the number of egg cells showing spindle fibre formation by 3 (from 2 to 5). Spindle fibre formation in egg cells does not increase beyond 33°C but rather stays the same at 5 egg cells.

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Examiner Comments

This answer demonstrates some of the poor phrasing which makes it difficult to determine whether or not to award a mark. 'Spindle fibre formation in egg cells' is not the same as 'number of egg cells showing spindle fibre formation'. However, there is an appropriate manipulation of the data for one mark, referring to numbers of egg cells. A mark was also given for the fact that there was no change above 33°C.

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Examiner Tip

To make sure you get the marks on data analysis questions, refer directly to the information or units provided in the headings of the tables of data.

(ii) Using the information in the table, describe the effect of temperature on spindle fibre formation in human egg cells.

(2)

the as the temperature decreases the number of spindle fibres forming becomes less and less. However at 33°c and 37°c all 5 egg cells showed 5 fibres. A drop of 5°c dec from 33°c to 28°c caused a decrease in spindle fibres to showing (2) and the lowest temperature (25°c) showed that 0 egg cells showed spindle fibres.

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Examiner Comments

This shows how confusing some responses can be - 'as the temperature decreases' is too vague - temperatures should be quoted. 'The number of spindle fibres forming becomes less and less' - there is no data given on number of spindle fibres. 'At 33°C and 37°C all 5 eggs showed 5 fibres' - again, where is this figure of 5 fibres coming from?

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Examiner Tip

Take care with how you express yourself - check that you're referring to the right units from tables or graphs.

(ii) Using the information in the table, describe the effect of temperature on spindle fibre formation in human egg cells.

(2)

As the temperature increased from 25 to 33°C, the number of cells showing spindle fibre formation increased from 0 to 5. There was no further increase after 33°C.

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Examiner Comments

This is a much clearer answer - easily gaining 2 marks. Although it does not refer to 'egg cells' but to 'cells' the stem of the question refers to 'human egg cells', so the context can be assumed.

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Examiner Tip

Keep to short sentences that make sense - that way both you and the examiner can be sure of the marks.

Question 4 (b) (i)

Most candidates identified the fact that only the 35°C statement was correct but could not clearly explain why. Others made a good start but then went on to explain how the 31°C statement was also true. A significant number of candidates appeared not have read the question thoroughly and didn't realise that the statement said '**all** 5 cells would have shown spindle fibre formation', and assumed it referred to any spindle formation. There were also incomplete answers provided, with no clear statement as to which temperature was being discussed, candidates expecting the examiner to obtain it by implication from the answer – please note, the examiner cannot give marks for points not clearly stated.

(b) A student made the statement that all 5 cells would have shown spindle fibre formation if the incubation temperature had been either 35 °C or 31 °C.

(i) Using the information in the table, give evidence to support part of this statement.

(2)

Between 33°c - 37°c there is no change. All of the eggs have shown spindle fibre formation. 35°c falls between 33°c and 37°c therefore all 5 eggs will show formation.

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Examiner Comments

A nice clear response gaining both marks.

Question 4 (b) (ii)

This question should have given a clue to the correct response for the previous question as it implied that one of the temperatures could not be supported. Yet again, the explanation was often lacking for a second mark. Many assumed linear proportionality between 25°C to 28°C, so predicted that a change in temperature from 28°C to 31°C would give increase of 2 cells with no reference to the result at 33°C. It would help if candidates structured their answers clearly, e.g. '31°C cannot be supported because…'.

(ii) Using the information in the table, give evidence that may **not** support part of this statement.

(2)

At 28°c, only 2 eggs showed spindle fibre. At 33°c, all 5 eggs showed spindle fibre. 31°c is in between 28°c and 33°c. It is not definite that all 5 eggs would show spindle as at 28°c only 2 showed spindle, could be 3 or 4 eggs. 31°c is close to 28°c than to 35°c – so more likely not all 5 eggs would show spindle.

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Examiner Comments

This is the type of answer given when a candidate has not thought through their response before starting to write. There is repetition of 'at 28°C only 2 showed spindle fibre' and much rambling. It does score 2 marks, one for implying that not all egg cells would show spindle fibres at 31°C, although it is not clearly stated; the second mark for the idea that there could be 3 or 4 eggs showing spindle fibres.

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Examiner Tip

Think through what you're trying to say before setting pen to paper (or finger to keyboard) - it helps you and the examiner!

(ii) Using the information in the table, give evidence that may **not** support part of this statement.

(2)

At 28°C only 2 cells formed spindle fibres; 31°C is between 28°C and 33°C so the number of ~~spindle fibres formed should be between 2 and~~ egg cells to form spindle fibres should be between 2 and 5

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Examiner Comments

This answer has been logically thought through and the original mistake concerning 'number of spindle fibres formed' has been spotted and corrected.

(ii) Using the information in the table, give evidence that may **not** support part of this statement.

(2)

- At ~~eff~~ the temperatures below 33°C only 2 (at 28°C) showed spindle formation
- ~~Biolog~~ 31°C may have ~~shows~~ 3 or 4 egg cells showing spindle formation but not all the 5 cells.

ResultsPlus
Examiner Comments

This response gains two marks - one for recognising that the data does not support the statement for 31°C and the other for suggesting the number of egg cells showing spindle formation would be 3 or 4, and not 5.

ResultsPlus
Examiner Tip

Bullet points help set out the answer clearly.

Question 4 (c)

There were many marking points available for this question and many detailed and well explained responses were seen, showing that candidates know this well and have practised explaining the adaptations of the sperm cell. In some cases, though, only one of a pair of answers was accepted because of poor expression, e.g. the streamlined shape of the sperm head was linked to "swimming more efficiently or faster", rather than just giving it low resistance in the fluid. As this was a QWC question, spelling was important and there were many candidates that could not spell 'flagellum' or 'zona pellucida' correctly and others seemed unaware of plurals such as flagella, mitochondria and nuclei – this was of particular importance with reference to a sperm cell having one flagellum, one nucleus and many mitochondria. Many failed to score a mark for mitochondria as they failed to qualify the reference, some even referring to a single mitochondrion. Confusion also arose where some candidates referred to the acrosome as being the enzyme, rather than being a vesicle containing enzymes. On the whole, this was a well answered question where marks were lost due to inadequate expression rather than a lack of knowledge.

*(c) Describe and explain **three** ways in which a human sperm cell is specialised for its function.

(6)

Contains The human sperm cell contains a flagellum which help the sperm swim to egg for fertilisation to occur so it can reach the egg for fertilisation to occur as it helps to propel movement. The sperm cell also contains a lot of mitochondria in the mid section as mitochondria are its the site of respiration therefore releases a lot of ATP in order to provide energy for sperm to swim to egg.

Also it contain acrosome which contains digestive enzymes so when sperm head comes into contact with egg cell, it can release the digestive enzymes during acrosome reaction in order to digest a channel in the zona pellucida to allow sperm to reach the egg cell surface membrane.

ResultsPlus

Examiner Comments

This is a good answer - containing plenty of relevant details to score full marks. This reflects the depth of knowledge the examiners expect for questions asking for descriptions and explanations.

*(c) Describe and explain **three** ways in which a human sperm cell is specialised for its function.

(6)

A human sperm cell contains the Acrosome which, on contact with the egg, releases digestive enzymes that burrow through the zona pellucida, thus creating a path for the sperm.

The sperm also contains mitochondria and this is a key element to the mobility of the sperm as the mitochondria provide energy for the flagellum.

The flagellum, as aforementioned, gives the sperm mobility. It essentially acts as a motor for the sperm and allows it to swim towards, and then through, the egg.

ResultsPlus
Examiner Comments

This response gains the mark for describing the acrosome releasing digestive enzymes, but nothing for explaining its function, as the candidate does not mention the break down or digestion of the zona pellucida - 'burrow through' is not specific enough for the mark (mp4). Another mark is given for mitochondria providing the energy for the flagellum, but their number or location is not described, so that mark (mp7) cannot be awarded. Then two marks are given for describing and explaining the purpose of the flagellum.

This response gained 4/6.

ResultsPlus
Examiner Tip

Use biological terms to make sure you get the marks.

*(c) Describe and explain **three** ways in which a human sperm cell is specialised for its function.

(6)

The human sperm is designed to have a flagellum, acrosome at the top of the head and mitochondria in it's body.
The flagellum ~~ett~~ enables it to swim in the direction of the egg, aiding its chance to fertilise the egg cell.
The acrosome at the top of the sperms head is released into the jelly-like substance surrounding the egg cell, to dissolve a path for the sperm to get through to fertilise the cell.
The mitochondria in the sperm's body provides the energy for the sperm to swim to the egg cell and to penetrate it in the hopes of fertilisation

ResultsPlus
Examiner Comments

This answer may appear to be a good one, but there are not enough details to score highly. Two marks are given for 'flagellum' and 'enables it to swim'. Nothing can be given for 'acrosome' as there is no mention of the enzymes it contains or what their function is - instead it suggests that the acrosome itself dissolves the 'jelly-like substance'. The only other mark that can be awarded is the one for stating that the mitochondria provide energy for the sperm to swim.

Total = 3/6

ResultsPlus
Examiner Tip

Make sure your answers have the right level of detail - but always try to write something. Although this candidate's knowledge lacks depth, they have still picked up 3 marks.

Question 5 (a)

This was a poorly answered question, with few managing to give a precise definition of a 'haploid nucleus'. Some attempted to describe 'haploid number' rather than refer to the nucleus, whilst others discussed the role of the haploid gametes allowing the restoration of the diploid number following fertilisation. The vast majority of answers referred to 'half the number of chromosomes', this is not sufficient, there has to be reference to which cell has the 'full number' – i.e. somatic cells. Better answers referred to only one set of chromosomes, or to only one from each homologous pair. A large number of candidates referred to 23 and 46 chromosomes, seemingly unaware that chromosome number differs between species. Hardly any candidates provided a description of the nucleus as an organelle containing the chromosomes.

(a) At stage 1, the pollen grain contains the haploid generative nucleus.
Explain what is meant by the term **haploid nucleus**.

(2)

A haploid nucleus is a nucleus that has only one set of chromosomes, so half the normal amount of chromosomes in a body cell. Haploid nuclei are found in gametes.

ResultsPlus
Examiner Comments

This is a good answer - the candidate refers to 'only one set of chromosomes' which is worth a mark on its own. They then go on to say 'half the normal amount of chromosomes in a body cell' which is an alternative way of saying the same thing. Then they gain a second mark for noting that haploid nuclei are found in gametes.

ResultsPlus
Examiner Tip

When asked for a definition, starting your answer with a phrase like 'A haploid nucleus is a ...' helps keep your answer on track.

Stating 'half the number of chromosomes' is too imprecise for AS Biology - it fails to make the distinction that only one chromosome from each homologous pair ends up in the haploid nucleus.

For example, half the number of chromosomes in a human gamete could mean that one gamete has a pair of each chromosome from number 1-11 and a single sex chromosome - this is obviously not the case! That is why examiners will not accept answers that lack precision when describing the haploid condition.

Also, a 'normal cell' is not the same as a 'somatic cell'.

(a) At stage 1, the pollen grain contains the haploid generative nucleus.
Explain what is meant by the term **haploid nucleus**.

(2)

This is the number of chromosomes in gametes and it is half the number of chromosomes of a normal ~~somatic~~ cell.

ResultsPlus
Examiner Comments

This candidate has straightaway shown that they are not answering the question asked. They are trying to describe what is meant by 'haploid number'. Then they cross out the one word that would have allowed this response to gain one mark - 'somatic' is the perfect way to describe a 'normal body cell'.

ResultsPlus
Examiner Tip

Read the question carefully - don't assume it's the same as one you've seen before doing practice papers. It may be similar - but there's a difference between 'haploid number' and 'haploid nucleus'.

Question 5 (b)

Most candidates gained one mark for recognising that the pH increased and then decreased, although there were many vague answers stating incorrectly that 'pH went down towards the tip', not noting the increase half way down. Several, aware that the answer required something more for the second mark, just repeated the values given in the diagram.
Not many correctly manipulated the figures; it appears that candidates are often able to quote data directly, but fail to state differences between data. There were also some who attempted to give reasons for this change in pH, therefore failing to identify the command word as 'describe' rather than 'explain'.

(b) Describe the changes in the pH of the pollen tube shown in the diagram.

(2)

At the top of the pollen tube it begins off neutral, the pollen tube then becomes gradually more alkaline until the pH begins to decrease towards the bottom and the pollen tube becomes more acidic.

ResultsPlus
Examiner Comments

This is typical of the type of answer given to this question - but it only gains one mark as there is no manipulation of the data provided.

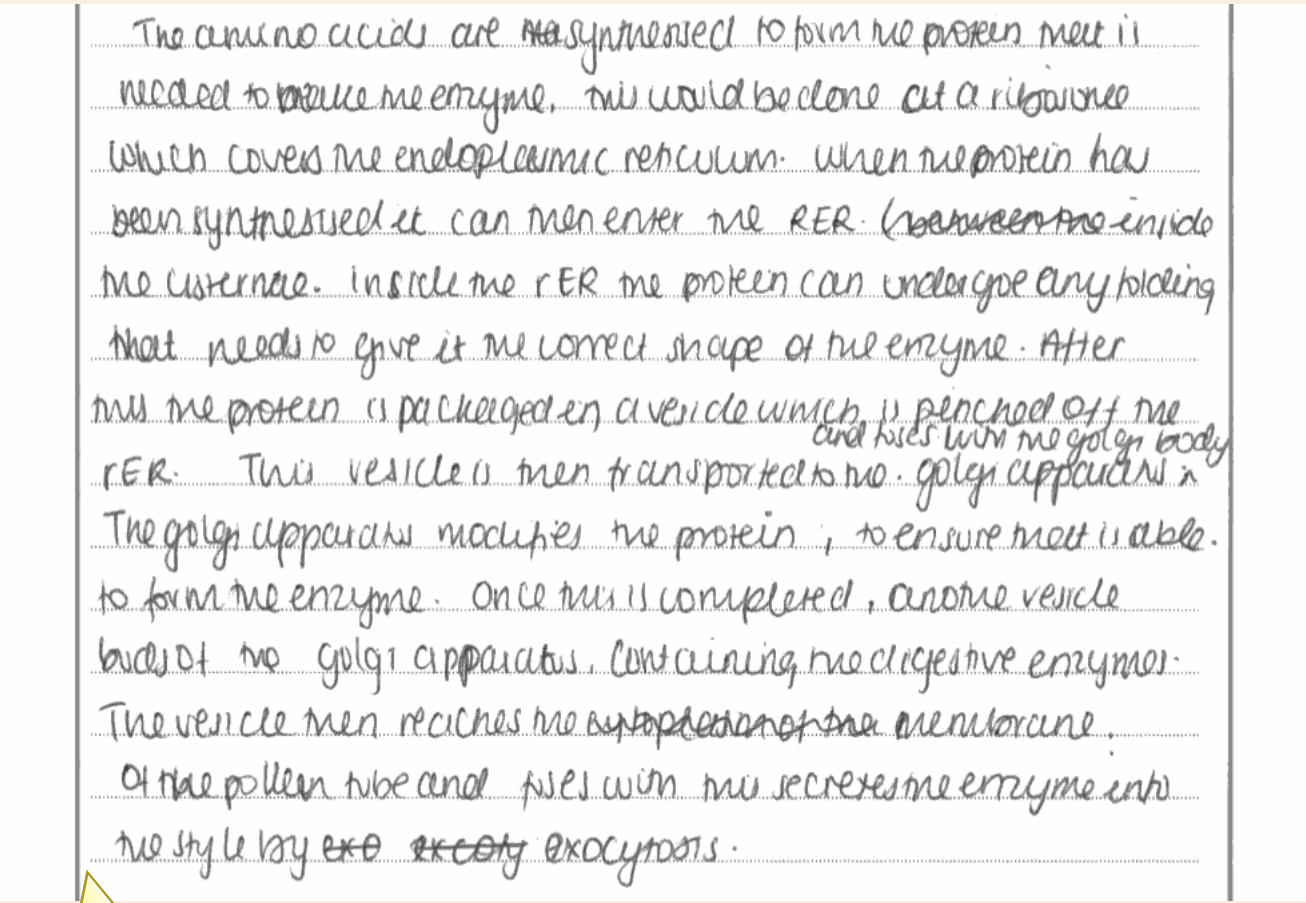
Question 5 (c)

Many candidates scored well on this question, giving credible and logical accounts of the fate of absorbed amino acids. There were a lot of marking points available for this question and those with an understanding of protein synthesis and transport found it easy to gain the 5 marks. The most common omission was the folding and forming of secondary and tertiary structure in the rER. Often there was no statement about the progression from amino acids to polypeptide to protein to enzyme. Some had amino acids being packaged in vesicles and eventually being passed out into the style. Meanwhile, some provided full descriptions of transcription and translation, rather than starting with the transport of the amino acids to the ribosomes.

Although the majority of candidates scored highly, there were also some disappointing responses which demonstrated confusion over the process of protein synthesis, e.g. amino acids carrying the code from the nucleus and ribosomes being packaged into vesicles in the Golgi. There were also many incorrect references to 'exocytosis' for vesicles being formed in the cytoplasm by the rER or the Golgi apparatus, as well as reference to vesicles 'bonding' or 'binding' instead of 'fusing.

This question really did discriminate between those who could describe the processes involved and those who could not apply that aspect of the specification to the context of enzyme production by pollen tubes.

There were many excellent answers to this question, easily gaining full marks.


The amino acids are ~~ha~~ synthesised to form the protein that it needed to make the enzyme. This would be done at a ribosome which covers the endoplasmic reticulum. When the protein has been synthesised it can then enter the RER. (~~between the~~ inside the cisternae. Inside the rER the protein can undergo any folding that needs to give it the correct shape of the enzyme. After this the protein is packaged in a vesicle which is pinched off the rER. This vesicle is then transported to the golgi apparatus and fuses with the golgi body. The golgi apparatus modifies the protein, to ensure that it is able to form the enzyme. Once this is completed, a new vesicle buds of the golgi apparatus, containing the digestive enzymes. The vesicle then reaches the ~~cytoplasm of the~~ membrane of the pollen tube and fuses with it secretes the enzyme into the style by ~~exo~~ ~~exocy~~ exocytosis.

ResultsPlus

Examiner Comments

Full marks given as follows:- ribosome involvement (mp2); packaging of protein in vesicle by rER (mp5); vesicle fuses with Golgi (mp6); protein modified by Golgi (mp7); Golgi packages enzyme in vesicle (mp8); enzymes released by exocytosis (mp9).

(5)

(*) Amino acids are picked up by ribosomes to synthesize proteins, &
(*) These ribosomes are attached to Endoplasmic reticulum
(*) Endoplasmic reticulum process the proteins, modifies them and packages them into vesicles.
(*) Vesicles are transfered from endoplasmic reticulum to Golgi apparatus
(*) Golgi apparatus modifies the proteins by adding the Carbohydrate chains. to them.
(*) These proteins are then packaged into Secretory vesicles
(*) They fuse with cell membrane and Cross it by exocytosis.
(*) These proteins are used as extracellular enzymes.

ResultsPlus
Examiner Comments

Full marks again. Awarded as follows:- ribosome involvement (mp2); vesicles move to the Golgi (mp6); Golgi modifies protein (mp7); proteins in secretory vesicles (mp8); exocytosis (mp9).

Note - mp5 not given as the answer does not make it clear that it is **rough** ER

ResultsPlus
Examiner Tip

Note use of bullet points ('stars'!) to separate the different points.

Make sure you refer to **rough** endoplasmic reticulum when describing protein synthesis.

Question 5 (d)

Although there were many examples showing a clear grasp of the process of double fertilisation, many lost marks through imprecise expression. When it comes to this process it is important to distinguish between nucleus and nuclei (AS Biology candidates are expected to know the difference). In flowering plants, one of the male nuclei fertilises the egg cell nucleus, not the ovum; the other fuses with the two polar nuclei (not polar bodies, these are found in the production of ova in animals).

(d) During stage 3, the generative nucleus divides to form two male nuclei and the pollen tube fuses with the embryo sac.

Describe what happens to each of these two male nuclei.

(2)

One Male nucleus fuses with the two polar nuclei in the embryo to form a triploid nucleus (3n) called the endosperm nucleus. The other male nucleus fuses with the female gamete nucleus to form the diploid (2n) zygote. - double fertilisation.

ResultsPlus
Examiner Comments

A good answer clearly showing that this candidate knows the difference between 'nucleus' and 'nuclei' and understands the process of double fertilisation in flowering plants.

When the pollen tube fuses with embryo sac, ~~#~~ one of the male nuclei which enters the ovule, will fuse with the egg cell producing a zygote/ embryo of diploid nucleus. The other male nuclei will fuse with the two polar bodies ~~#~~ in the ovule to form endosperm i.e. ~~triploid~~ triploid nucleus.

ResultsPlus
Examiner Comments

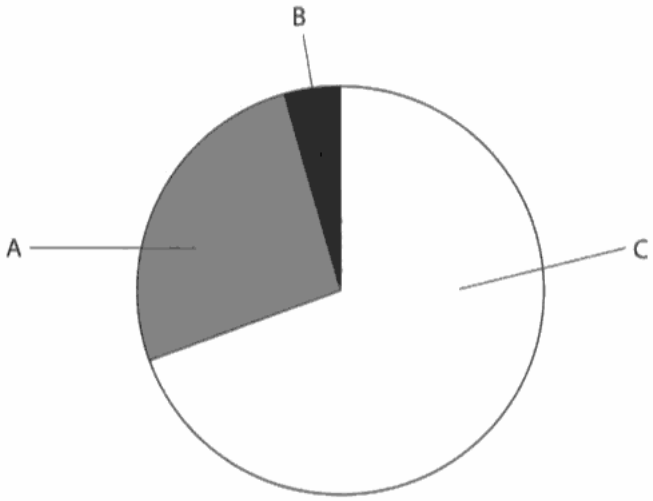
This answer just gains the mark for describing the fusion of one of the male nuclei with the egg cell. However, the other mark is lost as a result of referring to 'polar bodies' instead of 'polar nuclei'.

Question 6 (b)

Most candidates stated that 'C' represented phase 3 but said that it was because it was a 'large' group, rather than the 'largest' group. Many candidates worked too hard here. Instead of responding to the question and checking the data, they launched into long expositions of the various stages of drug testing and the reasons for them, this was because they misread the question and gave a reason for C needing a large sample size instead of giving a reason why C represented phase 3 of testing.

(b) The number of people tested is different in each phase.

The pie chart below shows the number of people tested in each phase of a drug trial.



Suggest which of the letters A, B or C, represents phase 3.
Give a reason for your answer.

(2)

Letter C

Reason This is the largest segment in the pie chart. Phase 3 requires the most patients (people) to test upon as this is the final phase

ResultsPlus
Examiner Comments

This answer gains two marks. One for giving the correct letter and the second for explaining that it was the largest segment in the pie chart. This candidate goes on to state that phase 3 requires the most people - this was not required for the mark, but shows that the candidate was covering all the bases to make sure they got the marks.

Suggest which of the letters A, B or C, represents phase 3.
Give a reason for your answer.

(2)

Letter C

Reason In phase 3 the largest amount of people are testing ranging from 1000-2000, and this has the biggest proportion on the pie chart.

ResultsPlus
Examiner Comments
A good answer, clearly explaining the reason for selecting C.

Letter C

Reason In phase three, large groups of patients are tested in double blind randomised control trials to test effectiveness of the drug.

ResultsPlus
Examiner Comments
This answer only gains one mark for C. The answer provided describes why there are a large number of people tested in phase 3 instead of explaining why C was chosen as the part of the pie-chart representing phase 3.

ResultsPlus
Examiner Tip
Read the questions really carefully - make sure that your answers fit the question.

Question 6 (c)

This question scored quite well, although candidates often failed to gain more than 3 of the 4 available marks. Most commented that the mean improvement of P was greater than Q. A significant number of candidates misinterpreted the heading in the table as 'age range' instead of 'range' and consequently discussed the effect of the treatments on patients of different ages. This is a careless error and comes from looking back through the data searching for answers rather than reading the data first. A further complication arose when candidates described 'lower' and 'higher' ranges, rather than 'narrower' and 'wider'. Once again there was often no idea about using the term 'range' and what it meant. Not many made the link between the size of the range and reliability or consistency. Realising that more statements were required to gain the marks many wrote about costs and side effects, disregarding the instruction in the question regarding 'using information in the table'. There were also many irrelevant discussions of the placebo effect. It is important that candidates use the mark allocation as an indication of the depth of answer required and stick to the instructions given in the question.

(c) The table below shows the mean percentage improvement of a condition in humans, when given one of three different treatments.

Treatment	Percentage improvement of a condition (%)	
	Range	Mean
Placebo	18 – 22	20
Drug P	45 – 51	49
Drug Q	41 – 51	46

Both drugs P and Q passed the three-phased testing protocol. However, only drug P was made available for use.

Using the information in the table, suggest reasons why **only** drug P was made available.

(4)

- Because drug P and drug Q treat the same condition but the mean improvement for drug P is higher than for drug Q by 3%.
- Furthermore the range of results for drug P was smaller so drug P is more consistent in its effects than drug Q and is therefore more reliable to use
- There is no point in making Q available if drug P is more effective and reliable therefore only drug P was made available
- The difference between the placebo and drug P was greater than the difference between the placebo and drug Q, showing drug P was more effective

ResultsPlus

Examiner Comments

This example gains full marks. In fact, all 4 marks are given for the first two bullet points.

The mean percentage improvement of a condition for drug P is greater than that for drug Q. For example, drug P causes 49% improvement of a condition compared to 46% of drug Q. This is one reason why drug P was made available.

Another thing is that the range for drug P is also smaller compared to that for drug Q. Smaller the range, ie closer the values in the data to the mean, the more reliable is the data. So, the result for drug P is more reliable than that for drug Q.

ResultsPlus
Examiner Comments

This answer got 3/4 marks. The first mark was given for 'mean percentage improvement ... for drug P is greater than ... Q'. However, the next mark was lost as this candidate quoted 49% and 46%, but failed to work out the difference. The other marks were gained for stating that the range was smaller for P and that this indicated greater reliability.

ResultsPlus
Examiner Tip

Don't just copy figures from tables - do something with them!

because drug P had obviously not caused harm to humans as it passed all 3 ~~test~~ phases, it also had the highest mean percentage of improvement, therefore would help improve the conditions of most people; and finally it had the smaller range out of drug P and Q, which both had quite similar mean percentage improvement, therefore there is a higher chance of drug P working than there is of drug Q working

ResultsPlus
Examiner Comments

This example gained 2/4 marks - one for 'highest mean percentage improvement' and the other for 'smaller range' for drug P.

Question 6 (d)

The majority of candidates got all 3 marks for this question. It was good to see so many following the instructions and using both ticks and crosses. There were also far fewer hybrid tick/crosses which are always marked as incorrect.

Question 7 (a)

Many candidates had learnt a standard definition for tissue, they wrote it down and scored both marks competently. However, others floundered constructing a definition from scratch, sometimes failing to make it clear that there are numbers of each cell type present, which is not the same as 'numbers of different cell types'. This proved to be more challenging than expected, again as a consequence of poor expression rather than lack of knowledge.

7 Plants are complex organisms that contain different tissues and organs.

(a) Explain what is meant by the term **tissue**.

(2)

the term tissue means a group of specialised cells working together to perform one function. This could be a group of endothelium cells lining the alveoli,

ResultsPlus
Examiner Comments

A good clear definition of the term 'tissue'. This response gains full marks. The candidate clearly understands what is meant by 'explain'.

7 Plants are complex organisms that contain different tissues and organs.

(a) Explain what is meant by the term **tissue**.

(2)

A tissue is a group of similar cells that work together.

ResultsPlus
Examiner Comments

This response gains just one mark for 'group of similar cells'. Although the candidate has written that they 'work together', there is no mention of a function.

Question 7 (c) (i)

Many candidates scored well on this question, although some stated that the plastic film would stop pathogens from growing on the agar, rather than prevent them from entering or leaving the beaker. The main problem here arose from a false conception that agar always contains bacteria, or that it is a dangerous substance.

The other main difficulty here and in 7cii was the muddling of the concept of a 'precaution' and a 'variable'. So prevention of entry of bacteria was claimed to be to make the experiment reliable, or a 'fair test'.

There was also a common lack of understanding of what plant growth substances were, many candidates evidently believed them to be food supplies, or present in large quantity and therefore toxic to humans.

(c) The diagram below shows two of the stages in a plant tissue culture technique, used to demonstrate totipotency in the plant tissue labelled U on the diagram on page 19.

Stage 1

A small sample of tissue U was placed in a beaker containing sterile agar and plant growth substances. The beaker was then covered with clear plastic film.

↓

Stage 2

The cluster of cells that formed on the agar began to specialise and eventually develop into a complete plant.

(i) Suggest **one** safety reason for covering the beaker with clear plastic film in stage 1.

(2)

So no bacteria that could be harmful to humans could enter and grow on the agar

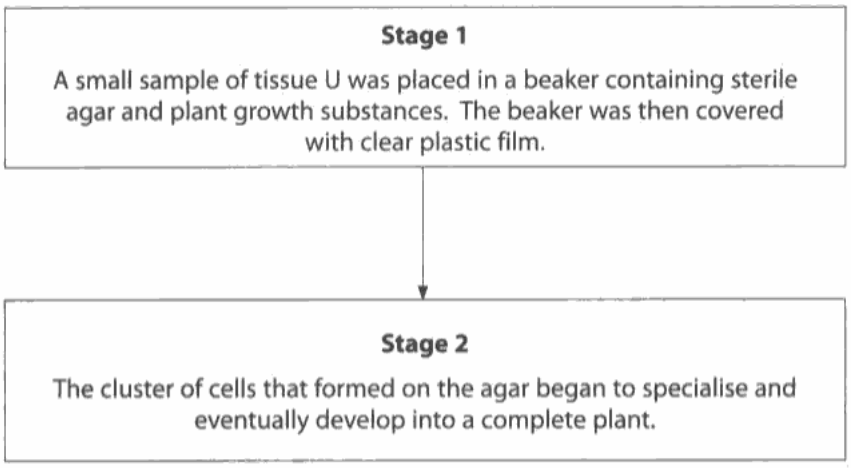
ResultsPlus
Examiner Comments

This answer gained two marks - one for preventing entry of bacteria and the other for realising that the safety reason (as underlined by the candidate!) concerned the fact that the bacteria could be harmful to humans.

ResultsPlus
Examiner Tip

When 'safety' is mentioned in a question it usually refers to the safety of the humans conducting the experiment.

(c) The diagram below shows two of the stages in a plant tissue culture technique, used to demonstrate totipotency in the plant tissue labelled U on the diagram on page 19.



(i) Suggest **one** safety reason for covering the beaker with clear plastic film in stage 1.

(2)

~~To prevent any germs or microorganisms to enter the beaker~~ beaker The plant growth substances may enter the eyes as powders or into nose which ~~is not~~ may harm. or cause coughing, sneezing.

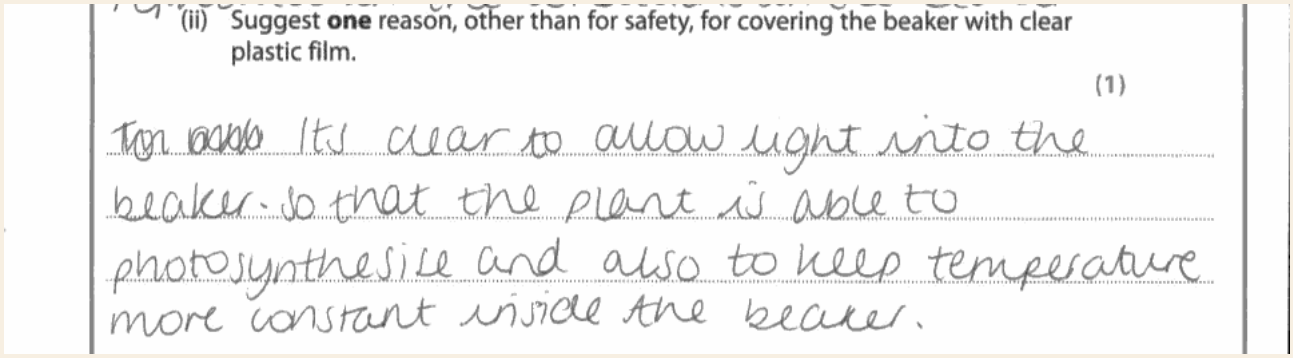
ResultsPlus
Examiner Comments

This is an example of a common answer provided referring to the dangers of plant growth substances. It scored no marks.

Question 7 (c) (ii)

Many candidates disregarded the context here and failed to realise that the transparency of the film was important, in order to let light through. Amazingly few mentioned photosynthesis. The phrase 'other than safety' was also either missed or misunderstood, leading to answers concerning contamination, which were accepted if related to the entry of organisms affecting the growth of the plant tissue.

Surprisingly, very few answers did refer to light being able to enter for photosynthesis. Many seemed to forget that plant tissue culture is about growing plants!


(ii) Suggest **one** reason, other than for safety, for covering the beaker with clear plastic film.

(1)

To make its clear to allow light into the beaker. So that the plant is able to photosynthesise and also to keep temperature more constant inside the beaker.

ResultsPlus

Examiner Comments

A rare example of the answer expected for this question!

Question 7 (c) (iii)

Many candidates gained all three marks on this question. Many correctly identified tissue R as xylem and recognised that it was dead, unable to divide and already differentiated. Many also used the term totipotency and could explain why xylem tissue could not be used to develop a plant. A few incorrectly referred to the tissue as being phloem or sclerenchyma.

(iii) No plant would develop if the plant tissue labelled R, on page 19, was used instead of plant tissue U.

Suggest reasons why no plant would develop if tissue R was used.

(3)

Tissue R dosen't contain live cells. ~~Xylem~~ Tissue R is xylem. Xylem is formed from dead cells. Dead cells can't divide and don't have ~~stem~~ totipotenty ~~stem cells~~ ~~st~~ totipotent stemcells are needed to produce a whole plant. If the cells can't divide ~~and don't~~ then a new plant tissue wont develop

ResultsPlus
Examiner Comments

There were lots of good answers like this one - clearly using the knowledge of the topics studied to explain why tissue R could not be used for tissue culture.

Question 8 (a) (i)

This was an easy mark for most. Some set about detailed explanation, despite the hint of only one mark being available and only limited space provided. Others seemingly decided the question expected complex reasoning and tried to balance germination success against size of seed, suggesting that smaller seeds would save space in a seed bank, and opted for seed sizes such as 3.5mm.

(i) Using the information in the graph, suggest which seed size would be considered the best for the seedbank to conserve, giving a reason for your answer.

(1)

A seed size of 7mm would be best as it has the highest germination success of 60, which is significantly greater than all the smaller seeds.

ResultsPlus
Examiner Comments

A good answer - providing a sound reason for selecting seeds of 7mm.

(i) Using the information in the graph, suggest which seed size would be considered the best for the seedbank to conserve, giving a reason for your answer.

(1)

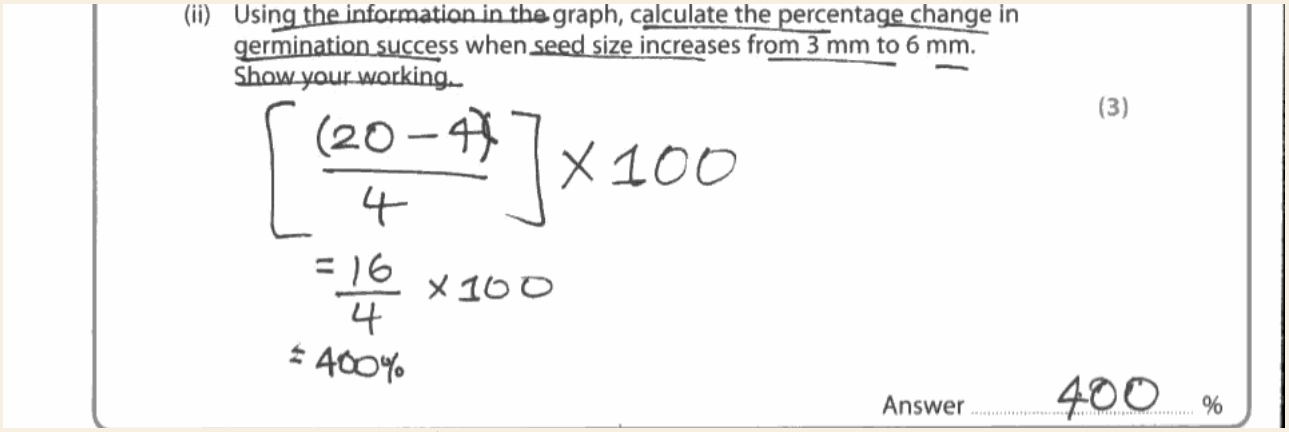
The seed sized 3.5 mm is the best, as it has the lowest germination success and therefore can be ~~used to~~ conserved and stored and seeds can be grown from this seed.

ResultsPlus
Examiner Comments

This candidate made the assumption that seeds with a lower germination success would be better to store - possibly thinking that the others would germinate whilst in storage.

Question 8 (a) (ii)

Many candidates apparently had no idea at all how to calculate a percentage increase, although a large number had identified the correct values from the graph. Some then went on to carry out the correct subtraction, but the majority could not take it any further, many divided 16 by 20, instead of by 4, not realising that they had to divide the difference by the original value to find the percentage difference. The mathematics involved was extremely easy and could be done without the use of a calculator, but unfortunately many had no idea how to work out the percentage. It is vital to practise these and similar calculations.


(ii) Using the information in the graph, calculate the percentage change in germination success when seed size increases from 3 mm to 6 mm.
Show your working.

(3)

$\left[\frac{(20-4)}{4}\right] \times 100$

$= \frac{16}{4} \times 100$

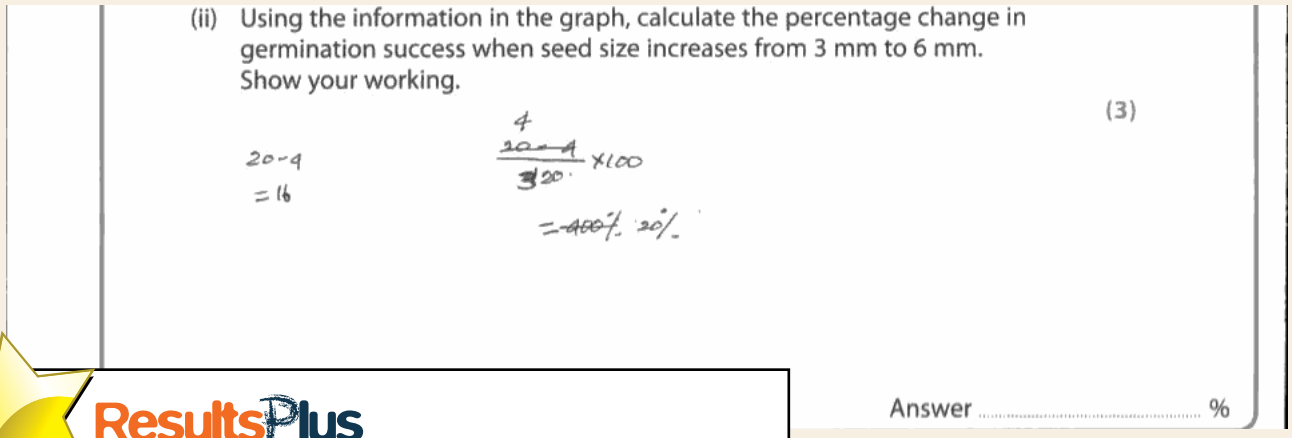
$= 400\%$

Answer 400 %

ResultsPlus
Examiner Comments

Clearly set out - a good grasp of the mathematics involved.

Full marks here.


(ii) Using the information in the graph, calculate the percentage change in germination success when seed size increases from 3 mm to 6 mm.
Show your working.

(3)

20-4
= 16

4
20-4 / 20 × 100
= 400% 20%

Answer ..... %

ResultsPlus
Examiner Comments

This is an example of where someone has the right answer, panics, crosses it out and replaces it with one that is wrong.

They still got one mark for getting 20 and 4 from the graph and correctly working out the difference between the two figures. They then got the right formula set out to calculate % change, but then, for reasons unfathomable, changed the figures and lost the final mark. It was lucky for them that they had not crossed 20-4=16!

ResultsPlus
Examiner Tip

Learn how to work out % change and practice the calculation - You **are** expected to be able to do this.

Question 8 (a) (iii)

Many candidates appeared to think that the question was about the seeds in storage having a better chance of surviving or ability to germinate. Few candidates scored full marks, the most common correct mark being given for mentioning genetic diversity. Most were aware of the fact that different size seeds would increase genetic diversity, but there was less evidence that they knew why genetic diversity would be an advantage. Some candidates did manage to explain that increased genetic diversity would lead to an increased chance of survival if conditions changed. This is another example of the type of question where poor expression hindered candidates, preventing them from achieving marks.

(iii) Seed size may be determined by the genotype of the seeds.
Suggest advantages of selecting seeds of different sizes for long-term storage.

(3)

Seeds with different sizes will have different genotypes, so this will maintain genetic diversity. This is important as otherwise some ~~g~~ alleles may be lost which could have given plants a characteristic which would have given them a selective advantage if enviromental conditions were to change. For example ~~them~~ plants from small seeds may have an increased chance of having an allele for larger leaves

ResultsPlus
Examiner Comments

This answer nearly scored full marks - but not quite. The first mark can be given for 'maintain genetic diversity' and then the second for clearly describing the concept of beneficial alleles. Although the candidate refers to changes in the environment, they have not stated that the greater genetic diversity, or beneficial alleles, will increase the chance of **survival**.

(iii) Seed size may be determined by the genotype of the seeds.
Suggest advantages of selecting seeds of different sizes for long-term storage.

(3)

This will increase genetic variation in future for the plant as seeds will contain different genes alleles which will increase variation, and natural selection.

ResultsPlus
Examiner Comments

This answer gains one mark for 'increase genetic variation' - however, despite mention of 'natural selection', the candidate does not appear to understand how increased genetic variation would be an advantage.

Question 8 (b)

Some candidates had obviously learned this material, whilst others appeared to simply make sensible suggestions, so that drying the seeds and storing them at low temperatures appeared often. However, there were some that seemed to believe that 25°C constitutes a low temperature. Many candidates mentioned dry and sterile conditions of storage, but failed to state that the seeds needed to be dried and their surfaces sterilised. The candidates were very confused about the regular testing for viability and the subsequent action. Most did not know that seeds were collected only if germination rate is low. There were also a large number of answers referring to: education, breeding programmes and re-introduction to the wild; many using learnt responses to questions regarding conservation of species, not appreciating that there are distinct differences to how animals and plants are conserved, seeds and plants do not need protection from predators and poachers!

(b) The best seeds will be selected for the seedbank.
Describe what the seedbank will do with these seeds to ensure the long-term conservation of the species.
(4)

• Wash the ~~Seeds o~~ selected seeds with ~~insecti~~ fungicide.
• Dry them ~~using fit~~ by heating.
• ~~o Pass X-rays~~ • Carry out an X ray analysis to check which ones have developed embryos, and hence viable. Select only viable ~~ones~~ ones for storage.
• Store the seeds in jars at −20°C (in a freezer) with no light, and low humidity.
• Check periodically to see if ~~so~~ at least 75% of seeds are viable or not.

ResultsPlus
Examiner Comments

This example gained full marks as follows:- cleaning seeds (mp2); drying of seeds (mp3); X-ray to assess viability (mp1); -20°C (mp4); checking viability (mp6).

ResultsPlus
Examiner Tip

Bullet points are a good approach to multi-mark questions like this. It's also a good idea to list more points than there are marks, in case one is wrong.

(b) The best seeds will be selected for the seedbank.
Describe what the seedbank will do with these seeds to ensure the long-term conservation of the species.

(4)

• The seeds will be washed, then sterilized. Then ~~they~~ the seeds will be X-rayed to check for a fully formed embryo. ~~The seed contains~~ Only viable seeds will be selected. They are then dried, to remove water. And are stored at -20°C. This ensure long-term storage because at lower temperature germination is inhibited as it slows down enzyme reactions.

ResultsPlus
Examiner Comments

Remember it's only the surface of the seed that gets sterilised - not the whole seed - that would kill it! This answer gains full marks for washing, X-raying, drying and then keeping the seeds at -20°C.

Paper Summary

In order to improve their performance candidates should:-

- read all of the details in the questions carefully making sure that they consider the context before writing their answers;
- develop a familiarity with the terminology encountered at this level and learn how to define key phrases accurately;
- review all of the recommended core practicals with particular reference to laboratory procedures;
- gain practice at interpreting information presented graphically and in tables;
- practice simple mathematical calculations – subtractions, and % differences;
- practice hand writing responses to questions to develop better skills at expressing themselves.

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