

Examiners' Report
June 2015

GCE Biology 6BI02 01

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Introduction

Generally, this paper was attempted well by most candidates. It was evident that some subjects within the specification are better understood than others. Most candidates demonstrated a sound grasp of the factual content of the course, such as the importance of different mineral ions to plants. The processes of protein transport within the cell, differential gene expression and natural selection were well understood by many candidates.

When it came to linking structure to function, there were many good answers to questions concerning sperm cells and xylem vessels. The application of knowledge concerning the role of zoos in conservation proved more challenging, catching out those who had learnt a particular stock answer and were unable to separate out the issues of inbreeding and conserving genetic diversity in a species.

Questions based on core practicals continue to differentiate between those centres where candidates have not only had the opportunity to carry out these investigations, but have also been encouraged to write up these experiments using correct terminology and precise details. The question on testing the antimicrobial properties of the seeds of a plant found in the rain forests of Costa Rica proved more challenging than was intended, mainly due to the problems encountered by candidates in concisely describing an appropriate procedure.

There were also many occasions when candidates lost marks as a consequence of failing to use the correct biological vocabulary, or confusing terms such as genes and alleles. It is important that candidates realise they need to communicate as scientists at this level of study.

Question 1 (a)

This question was generally well answered, with the most common error being to put a cross against eukaryotic cells for 'flagellum' - despite the structure of the sperm cell being in Topic 3 (and indeed in one of the questions in this paper), many forgot that some eukaryote cells may have flagella.

- (a) Complete the table below. If the organelle can be present, place a tick (✓) in the box and if the organelle could not be present, place a cross (✗) in the box.

(4)

Organelles	Prokaryotic cell	Eukaryotic cell
centrioles	✓	✓
flagella	✓	✗
Golgi apparatus	✗	✓
ribosomes	✓	✓



ResultsPlus
Examiner Comments

This response gained 3 marks for 6 boxes correctly completed. Errors made here were the commonest ones: mistakenly allowing centrioles in prokaryote cells and forgetting that some eukaryote cells may have flagella.



ResultsPlus
Examiner Tip

Read the question carefully - the phrase 'can be present' does not imply the structure is always present.

Question 2 (a)

This question was generally answered very well with most candidates scoring well. As a question focusing on QWC (Quality of Written Communication), marks were awarded for statements in a logical sequence, demonstrating an understanding of the processes involved as a protein is transported through the cell from the rER to the cell surface membrane.

The diagram proved to be very useful memory aid! However, not all candidates realised that the rER puts the insulin into vesicles, indeed many appeared to think that the protein becomes a vesicle at the end of the rER. There was also some confusion between the roles of the rER and the Golgi apparatus. Although there may be some modification of the protein within the rER, candidates are expected to know that the protein is folded into its secondary and tertiary structure in the rER, with further modification happening within the Golgi apparatus.

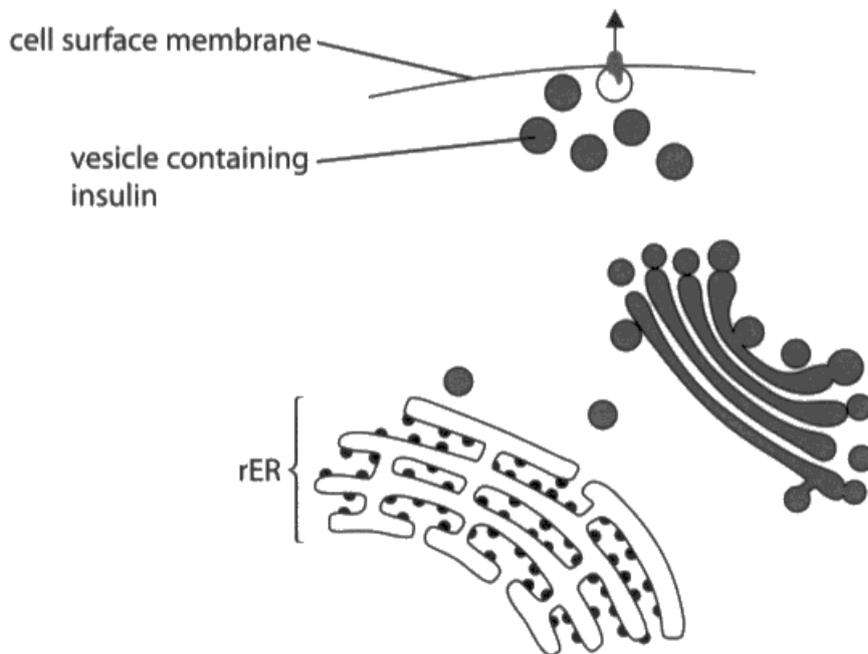
Those responses that did not score well were those where there was confusion between ribosomes, vesicles and proteins - with references to ribosomes moving through the rER and vesicles being modified in the Golgi apparatus.

The vesicles containing insulin are produced and start on the ~~at~~ smooth endoplasmic reticulum. ^{This is where any modification takes place.} The vesicles then travel throughout the cell, after being released from the smooth ER and they then attach themselves onto the rough endoplasmic reticulum. ^{where they are packaged} From the rER the vesicles are moved through the cell towards the cell surface membrane. The insulin is then secreted by the vesicles through the cell membrane.



ResultsPlus Examiner Comments

This response gained no marks, despite referring to the transport of insulin in vesicles. This is because the context was incorrect - describing the movement of the insulin from the smooth ER to the rER and then out of the cell. The structures in the diagram had not been correctly identified and the process was not described accurately.



*(a) Using the information in the diagram, describe how insulin is modified, packaged and secreted by the cell.

(4)

The insulin polypeptide ~~was~~ transfers through the rER where it is folded into its tertiary structure. It is then packaged into a vesicle. The vesicle then fuses with the golgi apparatus. It is then modified in the golgi. It is then packaged into lysosomes and transported. It is secreted by the cell in exocytosis. The lysosome is pinched off by the golgi.



ResultsPlus Examiner Comments

This response gained full marks for insulin being folded into tertiary structure in the rER, packaged into a vesicle, the vesicle fusing with the Golgi apparatus, modification of the insulin in the Golgi (generously allowed).

(The mark for exocytosis would not have been allowed for description of lysosomes instead of vesicles transporting 'it' from the Golgi.)



ResultsPlus Examiner Tip

Avoid referring to 'it' - although you know what 'it' refers to, this may not be clear to the examiner. In this response, the sentence 'The vesicle then fuses with the Golgi apparatus' is followed by one that starts 'It is then modified in the Golgi' - the 'it' could be interpreted as being the vesicle rather than the insulin and would not be given the mark. Better to make it perfectly clear, i.e. 'The insulin is then modified...'

Question 2 (b) (ii)

Many candidates were able to recall the process of differential gene expression and outlined it succinctly, gaining full points. Sadly, others floundered as if they were unfamiliar with the topic or had failed to grasp how to apply their knowledge to the question. Clarity of expression let many candidates down, such as referring to the mRNA transcribing the gene, rather than mRNA being produced by the process of transcription. Other common misconceptions were that RNA transcribes DNA, mRNA is 'transcribed', active 'cells' are transcribed and that active genes are 'read by' mRNA.

Responses that mentioned transcription factors and promoters tended to be unclear - these were probably written by candidates re-sitting this paper, having studied the topic in further depth in Topic 7; although this depth of knowledge is not required at AS, credit would have been given if the answer was clear.

- (ii) The pluripotent stem cells were injected into the mice. After eight weeks, these cells had developed into insulin-secreting beta cells.

Describe how these pluripotent stem cells became specialised beta cells.

(4)

Certain ~~stimuli~~ ^{stimuli} needed to activate certain genes, eg chemical
stimuli. Some genes are switched on & some are switched off.
mRNA can be made during transcription from ~~the~~ switched on (active)
genes, the mRNA is then made into protein during translation.
The protein made gives instructions to the cell and therefore
the cell's function is permanently changed and beta
cells begin to produce insulin.



ResultsPlus Examiner Comments

This response gained full marks for correctly referring to a chemical stimulus, the switching on of genes, mRNA produced by transcription from the active gene and the protein produced permanently determining the function of the cell.

Note - no mark could be given for stating that 'mRNA is made into protein during translation' - better to state that translation of the mRNA results in the production of a protein.

* Stimulus which is a chemical change takes place. Some cells are switched on and some are switched off. Those who are switched on get transcribed at mRNA during ^{after} blastocyst.



ResultsPlus
Examiner Comments

This response gained 1 mark for reference to a chemical stimulus. The common error of referring to 'cells' instead of 'genes' being switched on lost a mark. Then the muddled sentence concerning 'those who are switched on got transcribed at mRNA', was not creditworthy.

If this response had been better worded and more accurate, it could have gained 3 marks instead of 1.



ResultsPlus
Examiner Tip

Take care with terminology - genes are switched on or activated, not cells, and genes are transcribed to produce mRNA.

Question 3 (a) (i)

A straightforward question - all the candidates had to do was to work out the missing percentage from the table - however, a small number overcomplicated this question and came up with incorrect answers.

sperm cells with flagella defects	<u>3.9</u>	13.1*	<u>19.9</u>
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ResultsPlus Examiner Comments

Note that although the correct answer was given, the candidate has underlined the figures either side, which were irrelevant to this question.

Question 3 (a) (ii)

This question asked for a calculation of the difference in percentage between the 1.0mg group and the control group. The values in the table were as percentages, and the figures for 1.0mg and the control group were 3.9 and 19.9 respectively. One mark was awarded for selecting the correct figures from the table and performing a simple subtraction to give 16%.

On the whole, many candidates understood this. However, almost half of all answers given to this question were incorrect. Candidates seemed determined to work out percentages of percentages instead of reading the question with care.

- (ii) Using the information in the table, calculate the difference in the percentage of sperm cells with defective flagella in rats given 1.0 mg of nicotine per kg of body mass compared with the control group.

$$\begin{array}{l} \text{control} \rightarrow 3.9 \\ 1.0 \rightarrow 19.9 \end{array} \quad \begin{array}{l} 19.9 - 3.9 = 16 \quad (1) \\ \frac{16}{19.9} \times 100 = 80.4 \\ \underline{\underline{80.4\%}} \end{array}$$

~~19.9 - 3.9 = 16~~



ResultsPlus Examiner Comments

This candidate correctly identified the correct data from the table, conducted a subtraction to get the value of 16 and has then gone on to divide this by the higher value and convert the result into a percentage.

No marks could be given.



ResultsPlus Examiner Tip

Check exactly what is being asked in a question - difference in percentage is not the same as percentage difference.

- (ii) Using the information in the table, calculate the difference in the percentage of sperm cells with defective flagella in rats given 1.0 mg of nicotine per kg of body mass compared with the control group.

$$\begin{array}{r} 75.2 \\ - 19.9 \\ \hline 55.3 \end{array}$$

(1)

..... 55 %



ResultsPlus

Examiner Comments

This candidate took the wrong figures from the table - instead of reading from the column headed 'control', they took the value of 75.2 from the row for normal sperm in the column headed 1.0 mg nicotine.



ResultsPlus

Examiner Tip

Read all of the headings in tables of data before attempting a question on data from a table.

Question 3 (a) (iii)

The vast majority of candidates correctly identified the organelle as the mitochondrion. A few suggested acrosomes or nuclei, implying a lack of knowledge of the sperm cell's structure.

Question 3 (a) (iv)

This question was answered reasonably well, with most gaining 2 out of 4 marks. Most candidates made the correct connection between having a flagellum and the sperm using it to propel itself. Similarly, most were aware of the need for mitochondria in the mid piece to provide energy through respiration. However, many neglected to state the effect of nicotine on these organelles as requested in the question. Full marks could only be achieved by those who also mentioned that nicotine increased the number of sperm with flagella and mid piece defects; it was insufficient just to state that nicotine caused the defects, as they were also present in the control group.

A significant number incorrectly made reference to 'head defects' when the question clearly asked how nicotine affected **movement**.

(iv) Using the information in the table, suggest why nicotine reduces the movement of the sperm cells. *flagella, mitochondria*

If the sperm cell contains a defective flagella then it will not be able to effectively propel itself forward. It may not move at all or may just go in circles. (4)

If the sperm is missing its mid-piece it will not contain mitochondria and therefore will not be able to produce the energy (ATP) required for the movement of the flagella.



ResultsPlus
Examiner Comments

This was a very good answer describing why defective flagella or missing mid pieces would affect the movement of the sperm. However, there was no mention of nicotine, so marks were limited to 2/4.

(iv) Using the information in the table, suggest why nicotine reduces the movement of the sperm cells.

(4)

* ~~decreases~~ More nicotine ~~also~~ results in a increase of sperm cells with flagella defects. The flagellum is like a tail for the sperm and helps it move / swim. Defective flagella mean sperm can't move as well / less sperm can move.

* More nicotine also increases the ~~also~~ percentage of sperm cells with mid-piece defects. The mid-piece of a sperm is where the mitochondria are. Mitochondria give the sperm energy (through respiration), so any defects will result in the sperm not having enough energy and not being able to move as much.



ResultsPlus
Examiner Comments

A very good answer, describing how nicotine causes an increase in sperm cells with flagella defects and mid piece defects. There are descriptions of the roles of the flagella and the mid piece in the movement of the sperm cells, along with explanations why defects would reduce movement.



ResultsPlus
Examiner Tip

Note how this candidate has underlined and circled the key points in the question, helping them to focus on what is required for this question.

Question 3 (b)

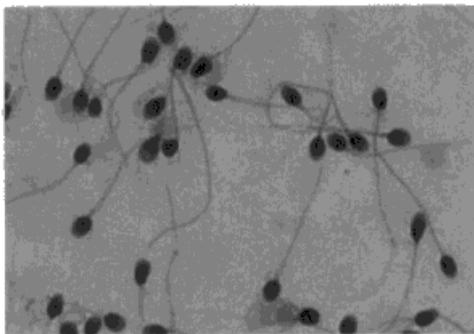
This question was answered reasonably well. Most candidates gained two marks for stating that the acrosome contained enzymes and that these enzymes were required for digesting the zona pellucida. Some mentioned the lack of acrosome reaction, although there were a few that were confused with the cortical reaction. Only more successful answers referred to sperm cells fusing with the cell surface membrane of the egg cell.

Some referred to the relative number of sperm cells in the second photograph, stating that fertilisation would be less likely if there were fewer sperm cells. This was not credited, as the question asked why the sperm cells in photograph B would not be able to fertilise an egg.

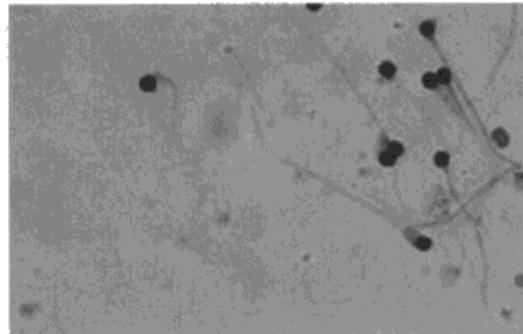
(b) A genetic cause of infertility is globozoospermia.

This condition results in round-headed sperm cells being produced. These sperm cells do not possess an acrosome.

Photograph A shows normal sperm cells and photograph B shows sperm cells from a man with globozoospermia.



A



B

Magnification $\times 500$

Suggest why the sperm cells in photograph B would not be able to fertilise an egg.

(3)

The sperm cells do not possess an acrosome. The acrosome contains digestive enzymes that digest the zona pellucida of an egg cell. This allows the sperm to fuse with the fertilisation to occur. However, the sperm cells in photograph B would not be able to fertilise the egg because they wouldn't be able to digest the zona pellucida.



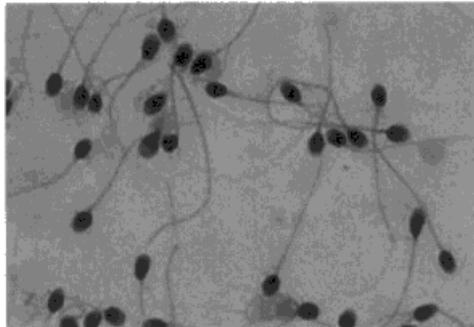
ResultsPlus
Examiner Comments

This was a typical response gaining 2 marks for recognising that the acrosome contained enzymes which are required to digest the zona pellucida.

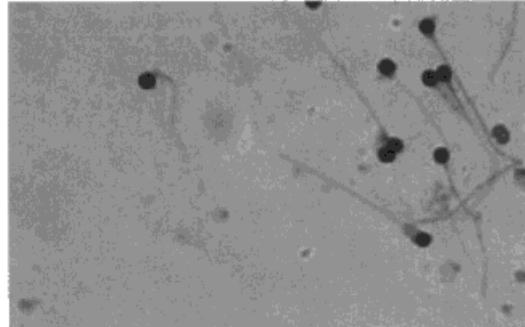
(b) A genetic cause of infertility is globozoospermia.

This condition results in round-headed sperm cells being produced. These sperm cells do not possess an acrosome.

Photograph **A** shows normal sperm cells and photograph **B** shows sperm cells from a man with globozoospermia.



A



B

Magnification $\times 500$

Suggest why the sperm cells in photograph **B** would not be able to fertilise an egg.

(3)

They do not have an acrosome, so they would not be able to have an acrosome reaction at the beginning of the fertilisation process. This means there will be no digestive enzymes burying a channel through the zona pellucida, so the sperm ~~head~~ ^{cell membrane} can never fuse with the egg cell surface membrane. This means the sperm haploid nucleus never enters the cell cytoplasm, the cortical reaction doesn't take place, meiosis isn't re-started and the nuclei cannot fuse in fertilisation.



ResultsPlus
Examiner Comments

This was a very thorough answer, gaining all marking points available for: no acrosome reaction, no enzyme, no digestion of zona pellucida and no fusion of the cell surface membranes of the sperm and egg cells.

Question 3 (c)

Many candidates failed to pull together all of the information they had been provided with in the question to tackle Q3(c). The question as a whole dealt with environmental factors (smoking) and genetic factors (globozoospermia) affecting fertility. This part of the question asked why any study on globozoospermia would have to be conducted on non-smokers. Correct answers should have referred to the fact that smoking reduces fertility, therefore any valid study on globozoospermia had to be conducted on non-smokers to control this variable, otherwise it would be difficult to determine whether the cause of sperm defects was the disease or the nicotine.

A large number of candidates ignored the question and just stated that non-smokers had to be tested in order to be a control to compare with smokers. Others thought that smoking increased the risk of globozoospermia and therefore failed to appreciate why non-smokers needed to be used.

Those who worked out the reason for carrying out the study where sperm would not have been affected by nicotine scored well.

(c) Suggest why a valid study on the effects of globozoospermia on fertility would have to be carried out on non-smokers.

(3)

Because nicotine has an effect on how successful fertilisation is. Therefore, scientists wouldn't be able to tell whether globozoospermia or nicotine was causing the effects shown in the results. If tested on non-smokers this variable will be controlled and the results will be more reliable.



ResultsPlus

Examiner Comments

Just enough for 3 marks - although more successful answers would have described reduced fertility, rather than an 'effect on successful fertilisation' (which may have been positive or negative).

Reference to reliable results was ignored, as the question was about a valid study, which involved the controlling of variables.

* Nicotine in cigarettes also affects fertility → it reduces fertility.

* Therefore, if you were to study smokers, you wouldn't be able to tell ~~whether~~ whether reduced fertility was down to the nicotine or the globozoospermia.

* Studying non-smokers would mean that the ~~are~~ results are more clear / ~~are~~ reliable.



ResultsPlus Examiner Comments

This response clearly referred to the fact that nicotine affects fertility by reducing it. Then a second mark could be given for explaining that if the study was conducted on smokers it would not be possible to determine what the cause was of reduced fertility.

The reference to reliable results did not gain a mark - the question was about validity of the study, not reliability of data.

2/3 marks awarded.

* Nicotine in cigarettes also affects fertility → it reduces fertility.

* Therefore, if you were to study smokers, you wouldn't be able to tell ~~whether~~ whether reduced fertility was down to the nicotine or the globozoospermia.

* Studying non-smokers would mean that the ~~are~~ results are more clear / ~~are~~ reliable.



ResultsPlus Examiner Comments

An interesting example which referred to DV and IV - and confounding variables. Although this showed the experimental design was understood, it was better to refer to the specific example in the actual question.

This gained 2 marks - one for explaining that variables had to be controlled and the other for explaining that nicotine causes faulty sperm cells.



ResultsPlus Examiner Tip

Try not to just refer to DV and IV - describe them, to make it clear you have understood the context.

Question 4 (a) (i)

There were many good descriptions of how to avoid contamination generally, referred to aseptic technique, with reference to the use of sterile equipment. However, there were additional details provided that would have been more relevant to the culturing of bacteria on agar plates, such as working near a Bunsen flame to provide an updraft. Because many failed to address the context, there were fewer references to covering the container in which the tissue culture was to be grown, other than descriptions of taping down of Petri dish lids.

(a) (i) Describe how contamination of a tissue culture is avoided.

(2)

Contamination can be avoided by performing tissue culture under sterile conditions. This means that all equipment used to undergo this technique are sterilised to remove any potentially harmful bacteria.



ResultsPlus

Examiner Comments

A general answer referring to sterile conditions. However, the context is just removing harmful bacteria and not in keeping out bacteria.

1/2

(a) (i) Describe how contamination of a tissue culture is avoided.

(2)

or cover
A lid is placed over the petri containing agar to prevent any contamination or growth of bacteria.



ResultsPlus

Examiner Comments

This response gained the mark for using a lid - it was assumed that the candidate was referring to the bacteria being kept out and not in.



ResultsPlus

Examiner Tip

Make the answer clear and completely unambiguous, e.g. 'to prevent any bacteria contaminating the agar'.

(a) (i) Describe how contamination of a tissue culture is avoided.

(2)

Aseptic techniques could be used when handling the tissue culture, for example alcohol and a flame could be used to sterilise anything that has or is about to come into contact with the tissue culture.



ResultsPlus
Examiner Comments

This response gained 2 marks for referring to aseptic technique and then describing it in the correct context.

Question 4 (a) (ii)

This question was answered poorly, with the majority only gaining 1 mark out of 2. Many did refer to the growth of the tissue culture being 'affected', but this was only creditworthy if a negative effect was described. There were many that also referred to avoiding competition, without describing the resource that would be used by the contaminants. There were also a large number of responses that mentioned pathogenic bacteria in the context of infecting the humans conducting the experiment instead of the tissue culture.

This question provided many examples of how marks were lost due to imprecise, vague answers that failed to address the actual question.

(ii) Explain why contamination of tissue cultures has to be avoided.

(2)

Contamination from harmful bacteria could inhibit the development and growth of the plant tissue culture. Contamination could possibly create harmful aerobic conditions which could have serious health impacts from those people exposed to the pathogens.



ResultsPlus
Examiner Comments

This was a typical answer, which gained 1 mark for referring to the inhibition of the growth of the plant tissue. However, there followed a confused description of contamination causing anaerobic conditions and people's health being impacted by exposure to pathogens.

1/2

(ii) Explain why contamination of tissue cultures has to be avoided.

(2)

This is to prevent microbes ^{such as} ~~and bacteria~~ ^{from entering} ~~to enter~~ the tissue cultures as they can ~~af~~ reduce the growth of the plant or even kill the plant. In addition, it can compete with the plant for nutrients in the agar. The bacteria can be harmful to the plants and humans.



ResultsPlus Examiner Comments

This gained 2 marks - one for reference to bacteria reducing the growth of the plant (or killing it) and one mark for referring to bacteria competing with the plant for nutrients in the agar.

2/2 - despite an irrelevant suggestion that these bacteria could be harmful to humans.



ResultsPlus Examiner Tip

If describing competition - be specific
- describe what is being competed for.

Question 4 (b) (i)

Generally answered well with the majority gaining full marks. However, those who had not carried out the core practical on which this question was based, lost marks by describing outdoor environmental conditions such as rainfall. Marks were also lost for suggesting that the volume of water provided would be kept constant - this is irrelevant when growing plants in tissue culture. A few also referred to maintaining pH - which is the independent variable in the investigation, and would be changed.

Most candidates achieved full marks for reference to light and temperature. Sunlight was accepted as many schools would place the plant tissue culture containers near a window for light.

- (i) Give **two environmental factors** that would have to be controlled when investigating the effect of pH on the development of shoots from the explants.

(2)

1 Temperature

2 Light Intensity



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Examiner Comments

Full marks were given for temperature and light intensity.

2/2

- (i) Give **two environmental factors** that would have to be controlled when investigating the effect of pH on the development of shoots from the explants.

(2)

1 Temperature

2 ~~Size of plant~~ weather conditions ie rainfall



ResultsPlus
Examiner Comments

This response received 1 mark for temperature - no mark for rainfall or weather conditions as tissue culture is conducted in sealed containers.

- 1 explants that are from the same plant * ^{almond (2)}
 - 2 keep the temperature the same
- ~~... started~~ *(e.g. same age)



ResultsPlus
Examiner Comments

This response received 1 mark for temperature.
The source of explants is not an environmental factor.



ResultsPlus
Examiner Tip

Read the question with care - although the source of the explants is a variable that should be controlled, it is not an **environmental** factor.

Question 4 (b) (ii)

The purpose of this question was to interpret the data provided - not just to describe it. Many candidates gained two out of three marks for noting the trend and describing the optimum pH for the growth of explants. However, there were those who described an increase in number of explants up to a pH of 6.5, or described a general trend with a pH of 6.5 being anomalous.

Fewer gained full marks, as the command word 'explain' was not taken on board. An explanation of the possible effects of pH on growth was expected - such as denaturation of enzymes or proteins, or low pH inhibiting the uptake of mineral ions. Stating that the pH affects growth was insufficient to gain this mark.

The mean number of shoots per explant increased up to the pH of 6.0. 6.0 is the optimum pH for shoots to develop. The pH of 6.5 is too ~~highly~~ high as it is almost at neutral so is less acidic.



ResultsPlus Examiner Comments

A typical response which gained 2 marks - one for describing an increase in mean number of shoots as the pH increased to 6.0 and one for stating the pH 6.0 is the optimum.

2/3

The mean number of shoots per explant increase continuously from 4.5 pH to 6.0 pH. It has a 3.3 rise in mean number.

However, it decrease sharply in mean number at 6.5 pH. This may indicate that at 6 pH is the optimum pH for the growth and

development of shoots from the explants and over 6.0 pH,

to pH value is too high which ^{affect and} slows down the growth of

almost plant shoot tips. High pH may lead to enzyme not able to

work and thus reduce in the number of shoots per explant.



ResultsPlus Examiner Comments

This response gained just enough detail for 3 marks - along with the trend correctly identified and an optimum pH of 6.0 suggested, there was reference to enzymes not working at high pH linked to the fall in shoot number at a pH of 6.5. The attempt at explanation was sufficient to gain the mark.

Question 5 (a) (i)

An explanation of biodiversity was required for this question - for full marks, reference to variety of species and a description of genetic diversity was required. Most candidates achieved one mark out of two.

Marks were lost for description of numbers of organisms, or references to plants and/ or animals only. The specification does require an understanding of what is meant by species.

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

(2)

THE NUMBER OF ORGANISMS WHICH LIVE IN
AN AREA, HOW MANY OF EACH SPECIES



ResultsPlus

Examiner Comments

This gained no marks - however, if the answer was written as 'number of species in an area', a mark could have been awarded.

either the variety of species living
in a given area (also taking into account
the abundance of each species), or the
variety of ^{different} alleles in the gene pool
for a species.



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Examiner Comments

A good answer which referred to variety of species and variety of alleles within the gene pool of a species.

2/2

Question 5 (a) (ii)

Although the question specifically asked for a method of measuring the species richness of the **rainforests** of Costa Rica, many candidates suggested counting all the species in the entire country.

Many vague responses failed to gain the mark, which was for the idea of counting the number of **species** in a given area.

- (ii) Describe how the species richness of the rainforests in Costa Rica could be measured.

(1)

The number of different species is counted.



ResultsPlus
Examiner Comments

Counting the number of species alone was insufficient to determine species richness.

0/1

Measure the amount of spec Find out the number of species and the amount of organisms within each species



ResultsPlus
Examiner Comments

No mark was awarded for the number of species and their population sizes without reference to area.

0/1

A sample could be taken of a square mile or so and it be counted how many different species there are in the sample



ResultsPlus
Examiner Comments

This response gained the mark for describing a method involving counting all the different species in a sample of one square mile.

Question 5 (b) (i)

This question was not answered well. Candidates are expected to understand the importance of maintaining biodiversity - and the course does this in the context of plants providing medicinal products.

It was hoped that candidates would use the information provided in the question to come up with an answer referring to loss of biodiversity leading to a loss of species, including potentially useful species yet to be discovered; these were the least commonly observed points made in the responses seen. Most of the answers seen that did gain a mark did so for noting that if certain species are **endemic** to a habitat they could become **extinct**.

Many candidates simply reiterated the information given - such as the fact that plants found in the rainforest had anti-bacterial properties. There were also references to losing the species already discovered - which did not gain credit.

(i) Suggest why the results of this investigation support the need to maintain biodiversity.

(2)

Because 6, a large proportion of the 15 species tested were endemic to Costa Rica, so if biodiversity is not maintained here they may become endangered or even extinct.



ResultsPlus
Examiner Comments

Although this response referred to the species in the table of data, a mark was awarded for recognising that loss of biodiversity could lead to extinction of endemic species.

Because there could be ^{species of} more plants which have ~~ant~~ antimicrobial properties which ~~could save lives~~ greater than those we've discovered already and so would be more beneficial to us to keep ~~them~~ a big biodiversity so we can discover more.



ResultsPlus
Examiner Comments

This response gained the mark for noting that there may be undiscovered species with antimicrobial properties - the implication is that if biodiversity is not maintained these may be lost.

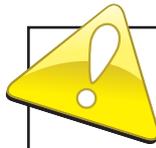
1/2

If the rainforest was burnt down, it would get rid of the species living in it ^{thus} ~~destroy~~ the species with antimicrobial properties meaning they wouldn't be able to be used in medicine. It needs to be maintained as there are benefits & if not it may lead to extinction of some species. Some species are endemic and only exist in one geographical location'.



ResultsPlus
Examiner Comments

This response gained 2 marks - one for describing loss of species and one for referring to endemic species becoming extinct.



ResultsPlus
Examiner Tip

Try to think first before writing the answer - try to make it perfectly clear what you mean.

This response could have been better worded as '... it may lead to extinction of some species that are endemic and only found in one geographical location'.

Question 5 (b) (ii)

This was an adaptation of the core practical on the antimicrobial properties of plant extracts. The fact that some appeared to be unaware of the procedure suggests that they had not conducted the core practical, which is a shame as this does undoubtedly disadvantage those candidates. There were a large number of answers that referred to placing whole seeds on top of agar plates.

The question itself was very straightforward - 'Describe how the antimicrobial properties of the seeds of the Jatoba plant could be tested'.

The first, and most common error, was failing to describe the production of an extract of **seeds**. This emphasises, yet again, the need to read the context of the question with care.

The next most common error was failing to describe practical procedures with precision. Marks cannot be awarded for vague references to a few days or 1-2 days incubation and leaving in an incubator. Many also failed to add any bacteria to the agar.

The more successful answers were those with enough specific details that would allow another person to follow the method in order to repeat the experiment described. However, please note that details of how to prepare agar are not required as it is assumed that these may be provided ready for use by laboratory technicians.

**(ii) The species tested included the Jatobá plant, *Hymenaea courbaril*.*

The photograph shows leaves, flowers and seed pods of the Jatobá plant.



©Smithsonian Tropical Research Institute

Magnification $\times 0.3$

Describe how the antimicrobial properties of the seeds of the Jatobá plant could be tested.

(5)

Grind the jatoba plant and place on small filter paper. On a petri dish of agar place 3 samples of the jatoba plant. ~~Place filter paper without~~ use a control of filter paper with no extract on it to make comparisons and ensure its not

the agar having an effect. Make sure this is aseptic conditions. Seal the dish to avoid bacteria entering. After a few days look at the dish to see the inhibition zone. ~~Compare to~~ Compare to the control which should have no inhibition zone. Ensure that the extract is from the same jamaica plant. ~~the~~



ResultsPlus

Examiner Comments

This was a typical answer lacking in relevant details.

No mark was given for grinding up the plant, no mark for agar plate without bacteria (although the dish was sealed to keep bacteria out), no mark for a control with no extract (it should be using the same solvent as used to make the extract) and no mark for leaving for a few days.

1 mark was given for reference to zone of inhibition.



ResultsPlus

Examiner Tip

Use precise details - describe the type of aseptic technique, e.g. use sterilised Petri dishes. Describe incubation period with precision, e.g. 24 hours at 25°C. Remember that testing antimicrobial properties requires the initial presence of bacteria - agar on its own does not contain microbes.

You could take a sample of the seeds and soak them in 10ml of ethanol to break down the coating / cell membranes using a pestle and mortar you would mash / break up the seeds in order to create an 'extract' of the Jaboba plant. Then, you would need to soak a thin disc of filter paper in the extract. Then you would place this disc on the jelly of an agar plate, ~~and~~ and seal the petrie dish using sellotape. Repeat this several times using the same extract on different agar plates. You would incubate the agar plates over 48 hours, and observe the size of the zone of inhibition that forms around the disc, where the extract inhibits the growth of bacteria and microbes. The larger this zone, the more effective the Jaboba plant seeds are.



ResultsPlus Examiner Comments

This was a more successful response, it gained 3 out of 5 marks.

Marks were awarded for a good description of the production of an extract of the seeds, placing this extract on a disc of filter paper and then, finally, observing the zone of inhibition.

Marks were lost by forgetting to add bacteria to the agar and for only referring to a time (48 hours) for incubating and not a temperature.

Repeating using the same extract is not enough to gain the mark for the idea of repeating the experiment - or using replicates to determine mean results.



ResultsPlus Examiner Tip

Full marks could have been achieved if this answer had a few more details, e.g. bacteria in the agar and a temperature for incubation as well as a time.

Remember - agar does not contain bacteria unless they are added to it.

You could first prepare a petri dish. You do this by pouring the molten agar into a sterile petri dish, allow it to set. You then create a lawn of bacteria which evenly covers the agar jelly surface. You now prepare 3 paper discs.

You first crush the seeds (around 3g) and then mix with 10cm³ of denatured alcohol. You dip your paper disc within the solution and allow it to dry (for up to 10mins). You must use sterile forceps for this. You prepare your second disc with half the concentration of the crushed seeds. You crush 1.5g and then mix with 10cm³ of denatured alcohol. Your 3rd paper disc is a control this is just placed in distilled water. You allow both to dry. You get your sterilized forceps and place each disc separately into the petri dish. Label the lid, place this on top with 2 pieces of cellotape either side. (allows O₂ flow + prevents contamination)

You leave this for a few days. You then check and measure the diameter of each circle with a ruler. The larger the clear circle the better the antimicrobial properties of the seeds.



ResultsPlus Examiner Comments

This was a very detailed response and it gained full marks. A description of the agar plate with a lawn of bacteria was described as was a detailed account of the production of a seed extract. Marks were also given for placing the extract on a paper disc and using aseptic techniques (sterile Petri dish and forcep). Another mark was given for measuring the clear areas, although this would have been better if described with reference to the extract.

Note - no mark for the control as it referred to distilled water, although the extracts were produced with alcohol, which would have been the control for this particular method described. There were also no details concerning incubation of the plate.



ResultsPlus Examiner Tip

Try to answer just the question being asked - for example this question did not ask about the effect of the concentration of the extract, but the response included details on how to prepare different concentrations.

Question 5 (b) (iii)

This question asked for reasons why drugs would be tested on animals and on human volunteers. Imprecise answers did not gain marks. Clear reference to testing on animals for toxicity and on human volunteers for side effects were fairly common and gained full marks. There were fewer who referred to the metabolism of the drug, which did not need to be confined to either animals or humans.

- (iii) Some of the plants tested could be used to develop new drugs to treat diseases caused by bacteria.

Before these drugs could be approved for use, they would have to be tested on animals and healthy volunteers.

Suggest why these drugs would have to be tested on animals and healthy volunteers.

(2)

To test if they are safe to use on humans
and to check if they have any bad
side effects.



ResultsPlus Examiner Comments

No marks were given for this response - the drugs would not be tested on humans to see if they were safe to use on humans.

A few more details would have made this response worth 2 marks, i.e. 'Test on animals to see if they are safe for humans. On healthy volunteers to check if they have any bad side effects'.



ResultsPlus Examiner Tip

Precise answers are needed to gain marks, don't lose easy marks as a result of missing out vital details needed to make your answer clear.

- (iii) Some of the plants tested could be used to develop new drugs to treat diseases caused by bacteria.

Before these drugs could be approved for use, they would have to be tested on animals and healthy volunteers.

Suggest why these drugs would have to be tested on animals and healthy volunteers.

(2)

They would need to be tested on animals to ~~test~~ test for toxicity and make sure it's not harmful to humans eg cause death etc. and needs to be tested on healthy volunteers to check for any side effects eg sickness, to determine the right dosage and to check the drugs being absorbed properly.



ResultsPlus
Examiner Comments

This response gained full marks, covering all the marking points. There was clear reference to testing on animals for toxicity, healthy volunteers for side effects as well as mentioning the absorbance of the drug.

2/2

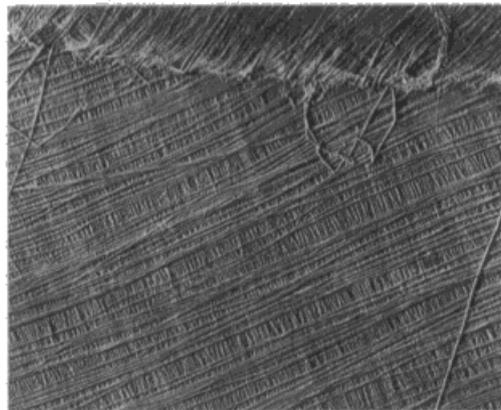
Question 6 (a)

This question asked for a description of the structure of a cellulose cell wall. Candidates were expected to mention chains of β -glucose, held together by hydrogen bonds to form microfibrils, which were then arranged parallel to one another or in a mesh, embedded in a matrix of pectin or hemicellulose. More successful answers did cover most of these points, however, there were many confused responses, muddling cellulose with microfibrils - for example having glucose molecules held together in a chain by hydrogen bonds. There were also references to lignin which did not gain a mark, as not all cell walls contain lignin.

Most candidates knew that cellulose was composed of β -glucose but failed to state that it was a chain or polymer and that the cellulose molecules combined to form microfibrils. Most also correctly referred to criss crossing of the microfibrils, although some referred to cellulose molecules here instead of microfibrils.

Again, precise answers gained marks and vague ones did not.

6 The photograph below shows part of a cellulose cell wall, as seen using an electron microscope.



© Biophoto Associates/Science Photo Library

Magnification $\times 70\,000$

(a) Using the information in the photograph and your own knowledge, describe the structure of a cellulose cell wall.

(3)

A cellulose cell wall is composed of many cellulose microfibrils in a matrix of hemicelluloses, pectin compounds and glycoproteins. Each microfibril is composed of many linear cellulose chains, made up of alternatingly 180° rotated β -glucose monomers, held together by many hydrogen bonds between protruding $-OH$ groups on the chain. The microfibrils are then arranged at angles to each other within the matrix to form a strong composite structure, the cell wall. There are small holes throughout the wall, however. The wall has a primary and secondary structure, the secondary being more rigid.



ResultsPlus

Examiner Comments

This was a good response, gaining full marks.

Unusually, it started with the microfibrils embedded in a matrix, then described the structure of the microfibril as chains of cellulose (β glucose polymers) held together by hydrogen bonds. There was also a description of the microfibrils 'arranged at angles to each other'.

3/3

A cellulose cell wall ~~is~~ is a straight chain polysaccharide which does not have side branches. It is bonded with hydrogen bonds to other ~~cha~~ cellulose chains and they form a net like structure called microfibrils. They provide strength and support to the cell. They are made of β -glucose.



ResultsPlus

Examiner Comments

This response contained many relevant details, but in incorrect contexts.

Cellulose is an unbranched polysaccharide - a cellulose cell wall is not.

Hydrogen bonds do hold cellulose molecules together to form microfibrils - but this is not what is said here.

Microfibrils are not a net like structure, they are arranged in a net like structure.

'They' are made of β - glucose - unclear what 'they' are.

1 mark was given for describing the structure of a microfibril.



ResultsPlus

Examiner Tip

To gain full marks, it is essential that answers are clearly written.

Rearranging the content of this response could gain full marks:

'Cellulose is made of β - glucose in a straight chain. Cellulose chains are bonded with other cellulose chains by hydrogen bonds to form microfibrils. The microfibrils are arranged in a net-like structure'.

- Cellulose cell wall consists of β Glucose.
- Joined by condensation ~~and~~ reaction
- 1,4 Glycosidic bonds are formed.
- They criss-cross each other and form hydrogen bonds b/w them.
- This is called a cellulose myofibril.
- They are long un-branched chains.



ResultsPlus Examiner Comments

No mark were given for 'cellulose cell wall consists of β -glucose' - must refer to cellulose consisting of chains of β -glucose to gain that mark.

No mark could be given for incorrect reference to hydrogen bonds and no mark for 'myofibril'.

0/3



ResultsPlus Examiner Tip

Make sure that references to key phrases or terms are used in the correct context, otherwise marks cannot be awarded.

Question 6 (b) (i)

Candidates are expected to be able to provide definitions of tissues and organs. Most candidates scored full marks here, having learnt the definition well.

(b) Cellulose can be used to produce biofuel. The xylem tissue in wood is a good source of cellulose. The cell walls of this tissue are heavily lignified.

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

(2)

A tissue is a group of organs working together to perform a particular function.



ResultsPlus Examiner Comments

A careless error here cost a mark - 'organs' instead of 'cells'. If this response was worded 'a tissue is a group of cells working together to perform a particular function' it would have gained 2 marks instead of only 1.



ResultsPlus Examiner Tip

Always check your answer - this candidate obviously knew the answer, but examiners cannot give marks if the answer is incorrect.

tissue is the combination of cells working together such as skin is a combination of epithelial cells.



ResultsPlus Examiner Comments

This answer missed out on the aspect of the cells in a tissue working together to carry out a particular function. It only gained 1 mark for the idea of a group of cells.

A group of similar cells which work together to carry out one specific function.



ResultsPlus Examiner Comments

A very good answer which covered a 'group of similar cells' and 'working together to carry out one specific function'.

Question 6 (b) (ii)

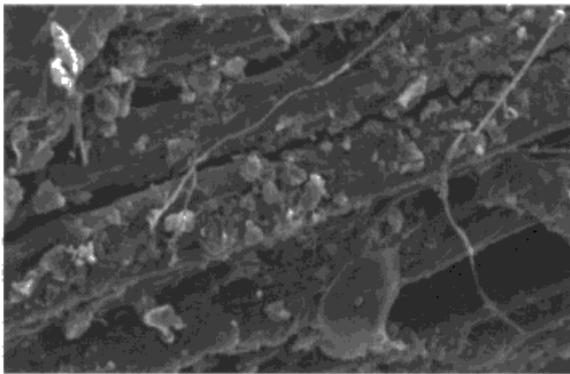
This question provided plenty of information, including the fact that the photographs showed **fibres** containing cellulose before and after the removal of lignin. The question then instructed candidates to use '**information from the photographs**'. Those who read the question and studied the photographs should have been able to state that the lignin held the fibres together and parallel to one another.

The fact that few candidates achieved full marks and that they referred to lignin holding xylem together, instead of the fibres, suggested that many failed to read the information provided.

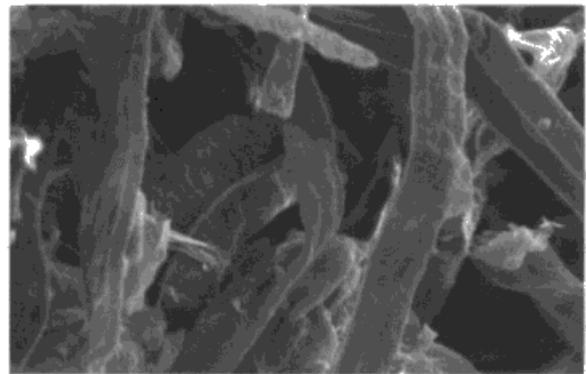
- (ii) The cellulose in the xylem tissue of wood has to be broken down by enzymes before it can be used to produce biofuels.

The lignin has to be removed before the enzymes can be used to break down the cellulose.

The photographs below show fibres containing cellulose before and after the removal of lignin.



Before removal of lignin



After removal of lignin

Source: SciELO

Magnification $\times 500$

Using the information from the photographs, suggest how lignin adds strength to xylem tissue.

(2)

Lignin sticks the fibres containing cellulose together and keeps them parallel which increases strength, because the tissues are stuck together.



ResultsPlus
Examiner Comments

An excellent answer, which clearly described the fact that the lignin 'sticks' the fibres together and keeps them 'parallel'.

2/2

Lignin is a sticky woody substance which sticks the fibres together, to give more rigidity to the tissue and supporting the plant. Before the removal, the fibres are stuck together, giving more strength than after the removal as the image shows fibres in a tangled state.



ResultsPlus

Examiner Comments

This response gained the mark for recognising that the lignin holds the fibres together, but failed to refer to them being in a parallel arrangement.

1/2

Lignin sticks to the fibres, making them thicker and giving them a higher tensile strength. It kills the cells, making them waterproof and strengthening them further.



ResultsPlus

Examiner Comments

This response just failed to gain any marks. It referred to the lignin sticking to the fibres, but not to it sticking them together. It then went on to describe the waterproofing property of lignin, which does not provide the fibres with strength and cannot be ascertained from the photographs.

Question 6 (c) (i)

This question was well answered, with many good descriptions of how the structure of xylem allows the transport of water, had been learnt well. Many referred to the hollow nature of the xylem vessel, with no cytoplasm, the lack of end walls and the presence of pits in the walls.

(c) Mineral ions such as calcium, nitrate and magnesium are transported in the xylem vessels. These mineral ions are dissolved in water.

(i) Describe how the structure of xylem vessels allows them to transport water.

(2)

Xylem vessels are hollow tubes with no end walls and have pits. They contain no cytoplasm so the hollow tubes allows water to pass through and move vertically in and out / between xylem vessels due to the presence of pits where no lignin



ResultsPlus
Examiner Comments

An excellent answer, which referred to hollow tubes, no end walls and pits in the opening sentence.

2/2

Xylem vessel is insoluble, which stops water from dissolving into it which means water can travel.

The xylem is strong and provides strength which helps the plant to stay steady whilst water is travelling through the plant by osmosis.



ResultsPlus
Examiner Comments

If this answer referred to lignin making the walls of the xylem impermeable to water - instead of just stating that xylem vessels are insoluble - it would have gained 1 mark.

0/2

Question 6 (c) (ii)

This was a very straightforward question testing the knowledge of the importance of three specific mineral ions to plants. On the whole, most candidates were aware of the function of nitrates in providing nitrogen for the production of amino acids and DNA, but there were a few that incorrectly described nitrates as containing protein. Many were aware of the importance of magnesium in the production of chlorophyll, although some did refer to chloroplasts instead of chlorophyll. Although some candidates knew that calcium played a role in cell walls, not all were able to describe its specific role in the production of pectate required for the middle lamellae.

(ii) Explain how calcium, nitrate and magnesium ions are used by plants.

(3)

Nitrates are used to make ^{amino} amino acids ~~and~~ to make proteins, for growth. Calcium is used to make calcium pectate which is involved in the middle lamella being formed. Magnesium is used to make chlorophyll which is used in photosynthesis.



ResultsPlus Examiner Comments

This response clearly gained all 3 marks for correctly describing nitrates as being required for making amino acid, calcium for calcium pectate and magnesium for chlorophyll.

3/3

Calcium is found between the plant cell walls and makes up the cytoplasm that helps keep them together. Nitrate ions are used in DNA to form nucleotides and deoxyribose sugars. DNA is needed to produce new cells. Magnesium ions are found in chloroplasts which are needed for photosynthesis.



ResultsPlus Examiner Comments

No mark was awarded for calcium in cell walls - lack of precise detail. No mark for magnesium being found in chloroplasts - should refer to chlorophyll.

1 mark was awarded for nitrates used in DNA to make nucleotides (the incorrect reference to deoxyribose sugars can be ignored).

1/3

Calcium is essential for the formation of a cell wall ~~and in bones~~

Nitrate ions are used for the formation of amino acids (by plants) and therefore is essential for growth and repair (along with) magnesium ions - which when deficient can cause the leaves of a plant to go yellow, therefore magnesium aids the chloroplasts



ResultsPlus

Examiner Comments

Another response which gained just 1 mark for nitrates being used in the formation of amino acids.

Common errors made here were referring to chloroplasts instead of chlorophyll, and to cell walls without specific details of pectin/pectate or middle lamellae.

1/3

Question 7 (b)

Causes of variation in beak size were commonly described as being environmental, with many candidates referring to birds apparently changing their beak size in response to different types of food available. This is disappointing, as the word 'variation' in the question should have been a clue for genetic variation.

More successful answers were seen referring to different alleles, mutations and polygenic inheritance - all of which could have accounted for differences in beak size within the medium ground finch, which had been described in the introduction to the question as a particular type of finch.

There were also some answers that described the process of natural selection.

(b) Medium ground finches have a range of beak sizes.

Suggest an explanation for the variation in beak sizes in medium ground finches.

(2)

They eat different kinds of seeds, some large, some small. This means different finches have different sized beaks bred in by ~~selective breeding~~ natural selection



ResultsPlus
Examiner Comments

A typical, incorrect response, which referred to different beaks to eat different seeds. Then the candidate referred to different finches, not taking on board that the question was about one type of finch. The reference to natural selection also suggested that the candidate had not understood the question.

Mutations, some could have a different beak size due to a mutation.

Also if there is a lot of genetic diversity some finches may have bigger / smaller beaks than others.



ResultsPlus
Examiner Comments

This response gained 2 marks for referring to mutations and genetic diversity as causes of variation.

2/2

(b) Medium ground finches have a range of beak sizes.

Suggest an explanation for the variation in beak sizes in medium ground finches.

(2)

This is due to the genetic variation in the species. Their alleles are different, which means their phenotypes (size of beaks) are different. The beak sizes may be a polygenic characteristic so the size of beaks in the species are all different because they have different genotypes.



ResultsPlus

Examiner Comments

An excellent answer, which referred to genetic variation and different alleles in the species. There was also reference to polygenic inheritance.

2/2

Question 7 (c)

This question required candidates to apply their understanding of natural selection to the data provided concerning beak size and survival of finches following a drought.

Some incorrectly identified the drought alone as the selection pressure, whilst very few candidates correctly identified the tough seeds as the actual selection pressure determining which size of beaks favoured survival.

The commonest marks awarded were for identifying which types of beak favoured survival and which ones did not - these were fairly easy marks to achieve, taking into account the fact that the rest of the marks were only awarded if the process of natural selection was correctly described in terms of **alleles** and not **genes**.

Candidates need to remember that the words **genes** and **alleles** are not interchangeable.

As always there were some responses that consisted of a stock answer of how natural selection works, rather than referring to any information or context given in the question.

Mean beak size / mm	Dead birds	Survivors
length	10.69	11.07
depth	9.42	9.96

As the population of the medium ground finches recovered, the mean beak size of the offspring increased.

Using the information in the table, suggest how this increase in mean beak size was brought about by natural selection.

(4)

The birds with the larger beaks had a circumvent advantageous characteristic. They were able to ~~eat~~^{crack} the larger seeds and therefore survived and ~~for~~ reproduced with other birds which had survived with larger beaks and therefore their offspring were likely to have larger beaks. The birds with smaller beaks would have died out because they could not eat the larger seeds. Therefore the number of birds with larger mean beak size would increase. They earned.



ResultsPlus
Examiner Comments

This response gained the most common marks awarded, those for recognising which beaks allowed the finches to survive and which ones did not.

2/4

The drought is the change in environment which was the stimulus to increase natural selection pressures. The competition for the ability to access the seeds of the tough fruit meant that the birds with the advantageous larger beaks could get to the seeds and eat them but those with smaller beaks could not eat therefore the birds with the larger beaks survived and smaller beak birds died population declined. The competition meant those with the ^{advantageous} allele for large beaks reproduced and passed on the large beak allele to offspring. Over time the population of birds with large beaks survived so the allele for this advantageous characteristic became more common. So the increase in mean beak size effected the majority of the population over natural selection over generations = evolution.



ResultsPlus
Examiner Comments

A good answer, which correctly identified the selection pressure, describing which birds survived and which did not. This candidate went on to attribute the larger beak to advantageous alleles, that were passed on to the offspring of these birds and increased in frequency in the population.

4/4

Question 8 (a) (i)

It was surprising that very few candidates could explain why inbreeding results in genetic defects. Many incorrectly attributed mutations, loss of genetic diversity and genetic drift to inbreeding. There were also many references to interbreeding, despite the word inbreeding being used in the question.

A common mistake was suggesting that breeding two closely related individuals causes mutations rather than appreciating that there is an increased chance of homozygous recessive defects.

There were a large number of responses referring to inbreeding causing a small gene pool, or reducing the size of the gene pool, whereas the issues that arise are due to there being a small gene pool initially.

There were very few responses that actually referred to inbreeding depression, although a few mentioned inbreeding causing depression. A simple response referring to breeding from closely related individuals will lead to inbreeding depression would have gained full marks.

- 8** In 2014 at Longleat Safari Park, a decision was made to humanely kill a female lion and four of her cubs. These lions showed violent and aggressive behaviour to other lions.

These lions had serious genetic defects caused by inbreeding.

- (a) (i) Suggest how inbreeding could have led to genetic defects in these lions.

(2)

When species are inbred, it produces offspring that have parents that have genetically ^{almost} similar DNA. Due to this similarity in genetics, it can cause genetic defects.



ResultsPlus
Examiner Comments

A common error was referring to closely related individuals having similar DNA - as seen in this response. Any individual of the same species is likely to have similar DNA - they tend to have the same genes, genetic differences are in the alleles, not the DNA.

By inbreeding the same alleles and similar genetics are combined causing mutations.

By a mutation of a gene characteristics such as aggressive behaviour can be passed on and that genetic defects were caused by inbreeding by not increasing genetic diversity.



ResultsPlus

Examiner Comments

No marks were given here for descriptions of mutations caused by similar 'genetics' and not increasing genetic diversity.

0/2

There is a small gene pool with low genetic diversity, this ~~has~~ greater chance of defective alleles being passed onto the homo therefore having genetic defects. Greater chance on passing on faulty alleles.



ResultsPlus

Examiner Comments

This response gained 1 mark for referring to a small gene pool to start with. The description of a greater chance of passing on faulty alleles was not creditworthy, but suggested that this candidate was on the right lines.

1/2

Inbreeding depression can cause an increase in homozygous recessive alleles. Recessive alleles are more likely to carry disease or defects which could lead to aggressive behaviour so



ResultsPlus

Examiner Comments

This response gained full marks for correctly describing inbreeding depression and describing the increased chance of homozygous recessive alleles.

2/2

Question 8 (a) (ii)

This question was fairly well answered with most candidates being aware of breeding programmes in zoos and the use of stud books. The question asked how to reduce the risk of inbreeding, therefore a description of keeping related animals apart may stop inbreeding, but no breeding will occur unless there is animal/gamete exchange between zoos.

There were many answers that contained a lot of irrelevant information, for example no marks were given for referring to releasing animals into the wild or using animals from the wild to breed with zoo animals.

More successful answers referred to using stud books to select mates that were not closely related, and then exchanging animals or gametes between zoos.

Sadly, there were quite a few responses that suggested breeding animals from different species, showing a lack of understanding of the whole concept of species.

zoos will not ~~be~~ breed animals from the same family eg. a male & female from the same mother. Sometimes, zoos will breed animals from slightly different species to increase biodiversity, prevent inbreeding and mix advantageous alleles for survival.



ResultsPlus Examiner Comments

This gained one mark for not mating closely related individuals.

No marks for mating animals from 'slightly different species'!

1/4

In breeding programmes, mates are selected carefully and recorded in a studbook to show who has mated with who. Zoos breed their animals with other zoos to increase the gene pool which can also be done by IVF. Animals are also given contraception to ensure that there is no inbreeding.



ResultsPlus Examiner Comments

This answer gained 3 marks for referring to studbooks, exchange of animals between zoos and the use of IVF.

3/4

Question 8 (b)

There were many excellent responses to this question, with thoughtful answers considering learnt behaviour, MAOA and genetic mutations. Good answers also referred to the fact that a change in a specific environmental factor - diet - had no effect on the offspring, suggesting a genetic cause.

Considering that this was the last question on the paper, almost all candidates made a good attempt at answering it.

- (b) When the female lion was first brought to Longleat Safari Park, the zookeepers noted symptoms including tremors, uncoordinated movements and aggressive behaviour.

It was thought that these problems were due to a poor diet when she was younger.

Her cubs were given a better diet at Longleat but they had the same symptoms as their mother.

Suggest what could have been the main cause of the problems in these lions.
Give a reason for your answer.

(2)

They may have a genetic issue with the amount of MAOA chemical their brain produces. Causing them to be angry.



ResultsPlus

Examiner Comments

This response was awarded 1 mark for recognising that it is a 'genetic issue' and 1 mark for reference to MAOA.

2/2

The cause would be down to their genes as they would have inherited the problem from the mother because when they changed the environment condition which was a better diet this had no effect on the cubs which means this was not the cause and it must be hereditary.



ResultsPlus

Examiner Comments

A good answer which suggested that the cause must be hereditary as a change in diet had no effect on the problems.

2/2

Paper Summary

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

- use appropriate biological terminology, use glossaries online and in text books
- take care when analysing data from tables or graphs, read the question with care
- when describing practical procedures, include enough detail that someone else could follow your instructions to repeat the same experiment
- read the questions and take into account the context as well as the command words used, do not try to make the question fit an answer you have learnt from the mark scheme for a previous examination.

Grade Boundaries

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

<http://www.edexcel.com/iwantto/Pages/grade-boundaries.aspx>

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