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Examiners' Report
June 2017

GCE Biology 8BN0 02

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Introduction

All questions were attempted by the majority of candidates; very few blank responses were seen.

There were some good quality responses throughout the paper and all the mark points were seen.

The multiple choice responses scored very well, there were few candidates falling for distractors and no distractor seemed to score significantly higher than others.

The quality of responses was lower than had been seen in previous years. Many questions of a similar nature to those in previous papers did not have the same detail or coherence in their responses. Despite this there were some excellent responses seen for all questions with some individual candidates scoring extremely highly throughout.

Question 1 (a) (i)

The majority of candidates could correctly identify β Glucose, with a pleasing number making a good attempt at the β. The main stumbling error was neglecting to state which type of glucose rather than incorrectly identifying α glucose.

(a) (i) Name the monomer that makes up cellulose.

(1)

beta glucose

ResultsPlus
Examiner Comments

This is the correct response, 1 mark is awarded.

ResultsPlus
Examiner Tip

Either beta or β are acceptable here. Use whichever you are more comfortable with.

Question 1 (b) (ii)

The response 'xylem' was considerably more popular than 'sclerenchyma' with the incorrect 'phloem' following a long way behind. A few candidates, disappointingly, gave answers such as 'cellulose'.

(ii) Name a plant tissue that has lignin in its cell walls.

(1)

xylem and sclerenchyma

ResultsPlus
Examiner Comments

This candidate correctly identified two tissues. They can only have one mark.

ResultsPlus
Examiner Tip

Remember 'a' calls for one answer. Don't give a list.

Question 1 (c)

The best responses to this question were very clear in their descriptions. The question was asking for structure related to function. Many correct statements were made about starch without correctly relating them to the function of storage. Less able candidates listed the structure of amylose and amylopectin but did not clearly state whether it was amylose or amylopectin that made the starch compact or rapidly hydrolysed.

Explain how the structure and properties of starch are related to its function as a storage molecule.

(3)

Starch is made up of amylopectin and amylose which have 1-4 and 1-6 glycosidic bonds. When starch is ~~so~~ broken down it provides rapid energy.
It is a branched polymer making it easier to break down.
It is compact and ideal for small spaces for storage.
Long-term storage molecule.

ResultsPlus
Examiner Comments

This response demonstrated knowledge of starch but did not have enough clarity to gain any marks.

ResultsPlus
Examiner Tip

Be specific in statements. When asked to relate properties to functions try to organise your ideas as you would complete a table before starting to write your response.

Question 2 (b)

It was clear in many responses that the '5 alleles associated with lupus' was misunderstood, a significant number answering as if it was a polygenic trait. Although a large number of candidates were able to state that females have two X chromosomes and males only one the significance of this was often not understood. The best responses correctly related this to the recessive allele and continued to get full marks. Weaker responses stated that two X chromosomes meant twice as likely to get the disorder.

(b) Alleles of a gene linked to the development of lupus have been located on the X chromosome.

Scientists tested 13 different alleles of the IRAK1 gene, which is located on the X chromosome. Five of these alleles were associated with lupus.

If these five alleles are recessive, explain how this could affect the ratio of males to females who develop lupus.

(3)

$X^e X^e$

$X^e y$

Females have 2 x chromozomes whereas males have an x and a y chromosome. The IRAK1 gene is sex linked to the x chromosome. If the alleles are recessive this means 2 of them would need to be inherited for lupus to develop. This would mean females are more likey to develop lupus as the recessive allele is linked to the x allele which females have 2 of.

ResultsPlus
Examiner Comments

This response shows an understanding of recessive inheritance but does not demonstrate the understanding of sex linked disorders. They were still able to gain one mark by stating the correct sex chromosomes for males and females.

ResultsPlus
Examiner Tip

Always give yourself the opportunity to gain marks by making clear points in a logical sequence.

(b) Alleles of a gene linked to the development of lupus have been located on the X chromosome.

Scientists tested 13 different alleles of the IRAK1 gene, which is located on the X chromosome. Five of these alleles were associated with lupus.

If these five alleles are recessive, explain how this could affect the ratio of males to females who develop lupus.

(3)

Females ~~X~~ (X X) whilst males have X Y.
Females ~~who~~ could need both recessive alleles
to be present to express lupus, where as
males would only need one allele since
it is missing the other allele, and it will
never be present. This means that ~~men~~ men
are more likely to have lupus since they
only need one allele, for lupus to be
expressed.

ResultsPlus
Examiner Comments

This response gained all 3 marks with a succinct explanation.

ResultsPlus
Examiner Tip

Don't feel you need to fill the space on the page if you have answered the question fully.

Question 3 (a) (i)

The term endemic seems to be widely understood from the responses seen and the mark was achieved frequently. A few candidates suggested that it was a term linked to the risk of extinction. The major grey area was the number of candidates referring to adaptation to a habitat, sometimes referring to Scotland as a habitat.

This response shows an understanding of the term endemic and has related it to the context of the question.

(a) (i) State why the Scottish wildcat has been described as **endemic**.

(1)

They are only found / unique to that one area (Scotland).

ResultsPlus
Examiner Comments

This was a pretty standard response.

ResultsPlus
Examiner Tip

Try to avoid giving learned definitions without relating them to the question.

Question 3 (a) (ii)

This was answered in a consistent manner, the vast majority stating that genetic diversity increased by the interbreeding with domestic cats. Frequently responses went on to give a definition of genetic diversity. This fell short of the need to *Explain* the effect. Few candidates were able to refer to the introduction of new alleles into the population; many gave ideas of changing allele frequency and genetic drift that they related to genetic diversity.

(ii) The Scottish wildcat can interbreed successfully with domestic cats.

Explain the effect this could have on the genetic diversity of the Scottish wildcat.

(2)

It would increase the genetic diversity as it would widen the gene pool.

ResultsPlus
Examiner Comments

This candidate gained one mark for increasing genetic diversity. Correct references to gene pool would still address the same marking point.

ResultsPlus
Examiner Tip

Make sure that you make enough distinct points in your response to match the number of marks available.

Question 3 (b)

Molecular Phylogeny is still a misunderstood concept. Few candidates were able to show that they understood that it is the differences in bases between a common gene, or amino acids in a common protein, that are examined. The responses were able to quote DNA frequently but often in vague terms. Similarly the second marking point was rarely awarded as description or comparisons were also vague, not relating the degree of similarity to the degree of relatedness.

(b) Explain how molecular phylogeny could be used to determine the relationships between the Scottish wildcat and other subspecies of European wildcat.

(2)

They can look at their ancestors and find out if they have a common ancestor. This can help to see if they're related in any way. They can also test both of their DNAs and see if there are any connections in the structure of DNA and blood.

ResultsPlus
Examiner Comments

The idea of a common ancestor is a recurring one. Very few linked it correctly to the idea of comparing similarities between subspecies. The idea of comparing the structure of DNA is not enough to gain a mark.

ResultsPlus
Examiner Tip

Molecular Phylogeny is used on specific genes or proteins that two groups have in common. It is the differences in *bases* or *amino* acids that are crucial.

Since Molecular phylogeny can look into the evolutionary history between the types of European wildcat and look into how similar their DNA and proteins and amino acid sequences are because the more similar they are, the more closely related their species is.

ResultsPlus
Examiner Comments

Although there is no reference to DNA bases the candidate has referred to amino acid sequences in proteins and has answered the question in full by describing how to determine the relationships.

ResultsPlus
Examiner Tip

Try to consider all aspects of the question.

Question 3 (c)

There were a number of easily obtainable marks available for the question. A disappointing number of candidates neglected the information in the question about the risk of interbreeding and others misinterpreted this as a positive. As such the idea of relocating animals away from domestic cats was rarely seen. The suggestion of removing them from predators was often the best attempt at responding to this aspect of the question. A lot of good descriptions of using studbooks or selecting mates were given, often going into detail about the need to maintain genetic diversity. Little thought to preparation for release was evident in the answers.

(c) Describe how the proposed conservation programme could prevent the Scottish wildcat from becoming extinct.

(4)

Captive breeding programmes aim to capture endangered animals and help them breed to increase the numbers. Therefore, more animals of these wildcats will be ~~breeded~~ produced. Captive breeding programmes use things like studbooks to maintain genetic diversity. They are then reintroduced into the wild in a way that ensures they will be able to survive on their own. For example, their food is slowly decreased to encourage hunting, they're released into safe habitats such as national parks with few predators and the locals are informed to ensure they're not hunted. This increases their numbers as more are produced and more survive meaning they're not extinct.

(Total for Question 3 = 9 marks)

ResultsPlus
Examiner Comments

This response shows the difference between more cats being produced and population numbers increasing. Only the latter is worthy of the mark. The only mark missed was the idea of relocation in context of the question, the context here being inbreeding with domestic cats.

ResultsPlus
Examiner Tip

Tick off the parts of the question that you have addressed, here it is interbreeding, captive breeding program and relocation.

Question 4 (a)

Responses were divided between the differences between Eukaryotic and Prokaryotic cell ultrastructure and those approaching the question via practical techniques such as microscopy, or molecular phylogeny. Although most candidates could describe differences, there were many who did not link this to the question. The fact that *P. falciparum* is eukaryotic was sometimes missed.

Describe how scientists could have determined that *P. falciparum* is a eukaryotic organism and not a prokaryotic organism.

(4)

The cell should contain membrane bound organelles such as a nucleus, ~~Abb~~ golgi apparatus rER and sER. The cell should also not contain a cell wall (if it is eukaryotic that is made of peptidoglycan). The cell would also contain 80s ribosomes if it is eukaryotic. Prokaryotic organisms have 70s. The cell should not have pili or a mesosome. If the cell is eukaryotic it should also not have a slime capsule.

ResultsPlus
Examiner Comments

This response showed both the organelles that the eukaryotic cell would contain as well as those it would not. The comparison is largely inferred here and could be more clear but still gains full marks.

ResultsPlus
Examiner Tip

A clear answer shows that eukaryotic cells have a nucleus *and prokaryotic don't*.

Describe how scientists could have determined that *P. falciparum* is a eukaryotic organism and not a prokaryotic organism.

(4)

A eukaryotic organism is one that has a nucleus and a prokaryotic organism is one that does not. Scientists could have determined they were eukaryotic as it could easily be seen through a light microscope. They could have also determined it was eukaryotic as it is a genetic disease which means that P. falciparum must have genetic material within it. They could have also determined it by it being multiplied which means that there is transcription and translation taking place within it.

ResultsPlus
Examiner Comments

This candidate gave an imaginative response that missed the link to the specification and therefore only picked up a mark for the nucleus.

Question 4 (b) (ii)

This was a good question to discriminate between candidates and a good spread of marks was seen here. The need to calculate a square root seemed beyond many candidates. A large number of candidates seemed to be attempting the question without the use of a calculator.

The Yoruba are a group of people who live in West Africa.

In a population of 600 Yoruba individuals, 24 were found to have severe sickle cell anaemia.

Calculate the number of heterozygous individuals in this population.

Use the Hardy Weinberg equation, $p^2 + 2pq + q^2 = 1$.

(3)

$q^2 = \frac{24}{600} = 0.04$

$q = \sqrt{0.04} = 0.2$

$p + q = 1$

$1 - 0.2 = 0.8$

$p = 0.8$

$2 \times 0.8 \times 0.2 = 0.32$

$= 32\%$

$1\% = 6$

$32 \times 6 =$

Answer 192

ResultsPlus
Examiner Comments

This is a nice clear response that gains full marks. Although 192 on its own would give 3 marks they have clearly stated values for q and p.

ResultsPlus
Examiner Tip

Check that your calculated answer lies within the expected range.

The Yoruba are a group of people who live in West Africa.

In a population of 600 Yoruba individuals, 24 were found to have severe sickle cell anaemia.

Calculate the number of heterozygous individuals in this population.

Use the Hardy Weinberg equation, $p^2 + 2pq + q^2 = 1$.

(3)

$p + q = 1$

$q^2 = 0.04$

$q = 0.2$

$\frac{24}{600} \times 100 = 4\%$

$p + q = 1$

$p + 0.2 = 1$

$p = 0.8$

$2(0.8) \times 0.2 = 0.32$

Answer 0.32

ResultsPlus
Examiner Comments

This response stops short of the final number of individuals, stopping with the % within the population. The candidate gains 2 marks but having done the 'hard work' has missed out by not relating the equation back to the data in the question.

ResultsPlus
Examiner Tip

Check back through the question to ensure it has been answered fully.

Question 4 (b) (iii)

This level-based question required use of information from the question and knowledge from the specification. Many responses only referred to the map and therefore did not progress beyond Level 1. The best responses used the data from the whole question as a platform to describe change in allele frequency by natural selection.

* Analyse the data to explain how malaria has affected the percentage of individuals in the Yoruba population with the allele for sickle cell anaemia.

(6)

The data shows that where there is an endemic P. falciparum there is a larger percentage of the population with the sickle cell allele. Therefore this shows that malaria has increased the percentage of individuals in the yoruba population with the allele for sickle cell anemia. The yoruba people have about 9-12% of the population with the sickle cell anemia and are in an area where there is the endemic P. falciparum that causes malaria. This shows that as malaria invades red blood cells it causes the sickle cell allele that deforms red blood cells to be more likely to produce severe sickle cell anemia.

ResultsPlus
Examiner Comments

This candidate has obviously referred to the graphs and therefore reached Level 1. There is an attempt at explaining the data and so the response gains full marks in this band.

ResultsPlus
Examiner Tip

Use multiple pieces of information from text, tables or diagrams to increase the level of your response.

9-12 % of the Yoruba population have the sickle cell anaemia allele. They are located very close in an area where the endemic P. falciparum is found; this eukaryotic organism is responsible for causing malaria, if untreated. Due to their proximity to the P. falciparum, the Yoruba people are at high risk of developing malaria. Due to the presence of malaria the Yoruba people face a significant selection pressure (as malaria kills so many); in this case it is advantageous to be heterozygous for sickle cell anaemia (have 1 sickle cell anaemia allele) because it makes them more resistant to cerebral malaria and therefore more likely to survive. As a result, carriers for sickle cell anaemia have been more likely to survive than homozygous Yoruba people. They have passed on their alleles to new offspring including the sickle cell anaemia allele, and now a greater percentage (9-12 %) of the Yoruba people have the allele for sickle cell anaemia. **(Total for Question 4 = 14 marks)**

ResultsPlus
Examiner Comments

This is a good example of a well-developed response that pulls information from different areas, linking them with relevant knowledge from the specification. The sustained line of reasoning ensures full marks at Level 3, all 6 marks.

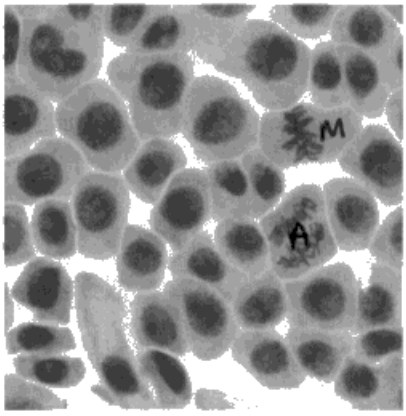
ResultsPlus
Examiner Tip

Link longer questions like this to content you have covered. You will need to go beyond the information given in the question.

Question 5 (a) (i)

The vast majority of candidates gained both marks for this question.

(a) The photograph shows onion root cells undergoing mitosis.



(i) Draw a line labelled **M** to one cell at metaphase and a line labelled **A** to one cell at anaphase.

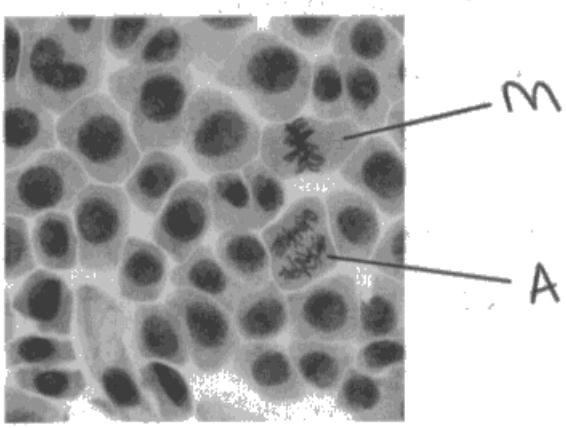
(2)

ResultsPlus
Examiner Comments

This response gets both marks for correctly identifying the cells in each stage.

ResultsPlus
Examiner Tip

Labelling onto a diagram can be unclear. Make sure you follow the guidance in the question.



(i) Draw a line labelled **M** to one cell at metaphase and a line labelled **A** to one cell at anaphase.

(2)

ResultsPlus
Examiner Comments

The candidate has made a clear indication of the correct cells and is awarded 2 marks.

Question 5 (a) (ii)

Most candidates correctly identified the stages of mitosis and therefore were able to gain full marks. The difficulties were often in rounding up too far or incorrectly, although some candidates neglected to multiply by 100.

Calculate the mitotic index for the sample of cells shown in the table.

(2)

462 + 23 + 24 + 4 + 16 = 529

23 + 24 + 4 + 16 = 67

67 ÷ 529 × 100 = 12.66540643

= 13%

Answer 13 %

ResultsPlus
Examiner Comments

This candidate rounded up their answer to 13 and lost the final mark. Thankfully they gained one mark as they showed how they arrived at the answer.

ResultsPlus
Examiner Tip

Always show your working, questions like this gain marks for each stage in the answer.

Calculate the mitotic index for the sample of cells shown in the table.

(2)

23 + 24 + 4 + 16 = 67

$\frac{67}{529} \times 100 = 12.7\%$ (3sf)

Answer 12.7 %

ResultsPlus
Examiner Comments

A good response, this candidate has also shown that they have given their answer to 3 significant figures. Both marks were awarded.

Question 5 (b) (i)

This question scored strongly on the first marking point but the second was rarely awarded. Significance of data is a well explored idea that seems to be overlooked.

(i) Describe the effects of Agil concentration on mitosis in onion root tips.

(2)

The greater the concentration of Agil the less the percentage of cells undergoing mitosis, negative corelation. It causes the rate of mitosis to slow down due to a disruption of the cell cycle The greatest change is from 0.0 to 0.5 ppm and the 1.0 ppm to 1.5 ppm has the least significant change in the cells undergoing mitosis 1.0 had the greatest significance due to the lower standard deviation, The meaning results were more close to the mean.

ResultsPlus
Examiner Comments

Although this candidate was almost there they stopped just short of a second mark. Although they considered the SE values given in the table, and referred to significance, they did not correctly identify an overlap.

ResultsPlus
Examiner Tip

Although a larger standard deviation does indicate a potential lack of accuracy in a mean, always look for overlaps with adjacent values.

(i) Describe the effects of Agil concentration on mitosis in onion root tips.

(2)

As the agil concentration increases, the mean mitotic index decreases. This is a negative correlation. This is shown when at 0 ppm, the mean mitotic index is 40.7 ± 0.22, then at 1.5 ppm the mean mitotic index is 30.8 ± 0.19.

ResultsPlus
Examiner Comments

This starts as a text book answer, comparing variables, as one increases, the other decreases. The candidate then gives the correct (negative) correlation. After that they have then simply quoted data. 1 mark was awarded.

ResultsPlus
Examiner Tip

To gain marks using data you will need to do more than just read them from a table. A graph maybe, but not a table.

Question 5 (b) (ii)

Although this was a standard question regarding a well-established core practical there were few candidates who obtained all 6 marks.

There were some well-described methods that neglected to change the correct variable, exposure time, instead describing a change in concentration. Another rarely seen mark was the counting of cells undergoing mitosis, many attempting to 'observe the mitotic index' or simply 'looking at the cells'.

(ii) Devise an investigation to determine the effect of exposure time to Agil on the rate of mitosis in onion root tips.

(6)

Several
by crushing the root tips and placing them in dishes of water, by heating at least one control of pure water and at least 4 of the dishes with varying amounts of Agil concentrations (all have a difference of 0.B).
5
Every minutes a section of the crushed root tips will be taken on to a microscope and the amount of cells in interphase counted, this should be repeated until half an hour has past.

ResultsPlus
Examiner Comments

This response shows a common problem. The candidate has used the example from the previous question (effect of concentration) rather than the exposure time as requested.

ResultsPlus
Examiner Tip

Always make sure you have the correct independent variable before you start.

(ii) Devise an investigation to determine the effect of exposure time to Agil on the rate of mitosis in onion root tips.

(6)

5 root tips of equal lengths and from the same source (controlled variable) should be placed in solutions of Agil of equal concentrations and volumes. However, the root tips should be left in these solutions for different exposure times (e.g: 5 hours, 10, 15, 20, 25 hours) - the independent variable. variables such as light intensity and temp should also be controlled as these factors might affect the mitotic index. Then each root tip should be chemically macerated (in HCl at 60°c), rinsed and dried, and then physically macerated with a mounting needle before placing on a microscopic slide. Add a few drops of Toluidine blue O dye and push down the cover slip (root tip squash) to obtain a single layer of cells that can be observed under the microscope. Count how many cells are undergoing mitosis in the different root tips exposed to Agil for different durations, and compare.

ResultsPlus
Examiner Comments

This candidate showed an understanding of the core practical method and has adapted it to the scenario. They obtained full marks, giving excellent detail.

ResultsPlus
Examiner Tip

Always try to keep a logical sequence when explaining practical technique.

Question 5 (c)

This was a novel concept that many candidates did not grasp very well. Although many stated that mitosis would be prevented, some highlighting anaphase as the affected stage, few grasped the idea correctly. Many instead described fibres being unable to reach the chromatids.

Explain how preventing the shortening of spindle fibres affects mitosis.

(2)

If the spindle fibres are short they can't attach to the centromere at metaphase. If Metaphase doesn't occur then mitosis can't continue

ResultsPlus
Examiner Comments

Although the question is about *preventing* shortening this candidate has not grasped the context so could not access any marks.

ResultsPlus
Examiner Tip

Be careful to read questions carefully, it is easy to skim over important points.

If the spindle fibres cannot shorten then the sister chromatids cannot be pulled apart and anaphase cannot occur. This prevents mitosis as two seperate cells can't be made as the genetic material of a cell cannot split.

ResultsPlus
Examiner Comments

This is a good response which gained full marks. The issue has been identified and the consequences explained.

ResultsPlus
Examiner Tip

Try to develop your answer from a simple statement to show the effect of any observation.

Question 6 (a)

Most candidates were able to achieve at least one mark here. There were some confused responses that were 'replanting fibres' and the idea of *more* plants being grown was rare.

(a) Give reasons why the use of fibres from plants is sustainable.

(2)

As plants are renewable, so if they start to run out you can grow more so if well looked after they will never run out.

ResultsPlus
Examiner Comments

Both marks were awarded here. The idea of planting or growing more plants was often overlooked.

because fossil fuels are finite so are non-renewable so plants ~~they~~ are natural and don't harm the environment if burnt. Plants as biodegs decompose quickly so won't be left in landfill for decades where fossil fuels would be + release harmful gases such as CO_2.

ResultsPlus
Examiner Comments

Sustainability is often confused with other environmental ideas. This candidate has explained the importance of renewable resources without actually stating that plants are a renewable resource, no marks are awarded.

ResultsPlus
Examiner Tip

It is better to answer positively rather than the converse.

Question 6 (b) (ii)

This question concerns one of the more difficult core practicals in the specification. Most candidates stopped short of calculating tensile strength and took it only as far as breaking the fibre.

(ii) Describe how the tensile strength of these fibres can be measured.

(3)

Use two wooden wedges to hold a fibre up with a clamp and clamp stand (measure the length and cross sectional area of the fibre). ✱ Tie a mass hanger to the end of the fibre. Gradually add masses onto the hanger ✱ until the fibre breaks. Record the total ~~mass~~ weight sustained. Calculate tensile strength (✱total force sustained / cross sectional area)

ResultsPlus
Examiner Comments

This candidate changed from mass to weight during their response but otherwise showed a good understanding of the method and scored 3 marks.

ResultsPlus
Examiner Tip

Using equations can sometimes be an alternative way to explain mathematical ideas.

Question 6 (c)

Although a simple question at first glance most candidates scored relatively low marks. The majority of candidates did not refer to a lack of correlation between lumen diameter and tensile strength, often describing a relationship that was not shown by the data. The need to *analyse* the data opens up an explanation of the relationship found, although few related it to lignin.

Analyse these data to evaluate the relationship between the structure of these plant fibres and their tensile strength.

(4)

As the cell wall thickness increases, the mean tensile strength increases. This shows a positive correlation - a linear relationship. The diameter of the lumen has little to no effect on the mean tensile strength. Curaua has the smallest lumen diameter but the highest mean tensile strength; Sisal had the highes lumen diameter but it's mean tensile strength was lower then the mean tensile strength of Curaua. The difference between the largest (Curaua) and smallest (Jute) mean tensile strength was 296 MPa

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Examiner Comments

This response started well, referring to both variables: cell wall thickness and lumen diameter. It scored 2 marks.

ResultsPlus
Examiner Tip

Consider each variable separately. Listing values or ranking examples is unlikely to gain marks.

Question 7 (a) (i)

Many responses were able to gain full marks by quoting definitions of tissues and systems although often the focus was on function more than structure.

(a) (i) Describe how a tissue differs in structure from a system.

(2)

A tissue is cells have the same function to do the same purpose. Different tissue has different purpose.

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Examiner Comments

This is a common response that instead of addressing structure referred to function instead; no marks were awarded.

ResultsPlus
Examiner Tip

Highlight the key terms in the stem of the question, in this case 'structure'.

A system is made up of multiple tissue types containing different specialised cells however a tissue is only made up of one type of specialised cell.

ResultsPlus
Examiner Comments

This response gains both marks, comparing structure very clearly.

Question 7 (a) (ii)

Few responses gained full marks for this question. The idea of different stimuli leading to different cells was rarely mentioned. Less able candidates were unable to clearly explain the process or transcription and translation and picked up only one or two marks.

A few candidates referred to methylation of DNA and deactivation of genes rather than activation.

(ii) Describe how mesenchymal stem cells can give rise to different types of cell. survive

(4)

Stem cells are unspecialised cells that can differentiate to form ~~different types of~~ specialised cell. This will happen as a result of a stem cell being in a particular chemical environment, which'll act as a stimulus, causing some genes to become active and others to remain switched off. This means that active genes are transcribed to produce mRNA molecules, which are then translated to synthesis a protein. Depending on the protein made, it will determine the structure and function of a cell and hence give rise to a range of different types of cell.

ResultsPlus
Examiner Comments

This was typical of many responses, gaining three marks by describing differential gene expression. The additional reference to different proteins gained full marks.

Question 7 (b)

A wide range of values were given for this calculation.

There were difficulties in reading off the scale as well as in converting to the required units of percentage per year.

Calculate the rate at which the percentage of mesenchymal stem cells in the bone marrow changes between the ages of 14 and 30. $30 - 14 = 16$

(2)

$0.001 - (4 \times 10^{-4}) = 6 \times 10^{-4}$

$\frac{6 \times 10^{-4}}{16} = 3.75 \times 10^{-5}$

Answer 3.75×10^{-5} % y^{-1}

ResultsPlus
Examiner Comments

Full marks were given here for the correct answer. It was pleasing to see use of standard form.

ResultsPlus
Examiner Tip

Take values from tables and graphs in the same format.

Calculate the rate at which the percentage of mesenchymal stem cells in the bone marrow changes between the ages of 14 and 30.

(2)

$\frac{0.001 - 0.0004}{0.001} \times 100 = 60\%$

ResultsPlus
Examiner Comments

This gains one mark for correctly extracting data from the graph.
It was a common error to calculate a percentage change rather than the rate.

ResultsPlus
Examiner Tip

Look for units on the answer line.

Question 7 (c)

On the whole this was answered competently.

(c) Deduce why age affects the time taken to recover from injuries.

(3)

The older a person gets, the lower the percentage of mesenchymal stem cells in their bone marrow. This means if their body cells (e.g. bone cells) became damaged (e.g. broken arm), they would have less stem cells to differentiate into bone tissue and therefore the process of healing would be longer.

ResultsPlus
Examiner Comments

This candidate succeeded in gaining all three marks. They have related the question to a broken arm and shown the link from Mesenchymal stem cells differentiating into cells to repair the specific injury.

ResultsPlus
Examiner Tip

Link the response back to the original context, here the context was bone, muscle and cartilage tissue.

Question 8 (a)

This question gave a lot of data to comment on and there were many different approaches made to do so. Many candidates focused heavily on the subjective and the difference between subjective and measured improvement. The comparison of Albuterol, placebo and no treatment was less common and therefore fewer marks were given.

Comment on the measured improvement (FEV improvement) and subjective improvement for the different treatments.

(3)

when albuterol was given, the people improved the most both subjectively and with measured FEV. The subjective improvements for all three treatments were significantly higher than the measured FEV improvements The placebo FEV improvement and no treatment FEV improvement were very similar but the subjective improvement for the placebo was very different to the subjective improvement when no treatment was given. This shows that when given a placebo, people thought they felt a lot better when in reality, it had little effect.

ResultsPlus
Examiner Comments

This response gave enough detail to cover the marking points as well as considering the difference between subjective and measured improvement.

ResultsPlus
Examiner Tip

Consider the relevance of the data to the context rather than the data alone.

Question 8 (b) (i)

Few candidates paid attention to the stage of the drug trial mentioned in the question. Many candidates wrote about effectiveness of the drug, presumably in treating those suffering with asthma, although only healthy volunteers were used.

(i) Explain why healthy volunteers were given different doses of the drug or a placebo.
(2)

They were given the drug to see the possible side effects of both the drug and the effect of the placebo on healthy volunteers. They may have used different doses to find a safe dosage to give patients.

ResultsPlus
Examiner Comments

This response gained the mark for a relevant reference to side effects. The reference to placebo did not warrant any marks. The idea of finding a safe dose was evident here.

ResultsPlus
Examiner Tip

When given two points to consider, be clear which one you are writing about. Different doses of the drug? or the Placebo?

They were given different doses to find out the ~~effect~~ which dose was effective. To also find out the safest dose to give. The results would show if a higher or lower dose was dangerous or if it produce fewer side effects.

ResultsPlus
Examiner Comments

This was a common error, referring to the drug being effective. Within the context of healthy volunteers this is not correct.

Question 8 (b) (iii)

A nice finish to the paper – this gave candidates who had learned the digitalis soup protocol a chance to achieve all three marks. The best responses started with the details from the modern drug trial and linked back to William Withering's experiments. Weaker responses wrote about Withering first and then tried to find parallels in the given example.

(iii) Compare and contrast this drug testing protocol with that used by William Withering when he tested digitalis soup.

(3)

Both drug testing protocols give the drug to humans and monitor how the body reacts to the drug and both protocols use a range of different concentrations of the drug in order to determine a safe dosage. However, while this drug testing protocol gives the drug to healthy volunteers, Withering gave the drug to patients with the disease. Moreover, unlike this drug testing protocol, Withering's protocol did not use a placebo.

ResultsPlus
Examiner Comments

This was a well-written response that gained full marks. Each point was clearly linked showing either similarity or difference with both protocols. The command words being underlined show that thought was given before the candidate started their response.

ResultsPlus
Examiner Tip

Know your command words!

Paper Summary

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

- read the question carefully, pay attention to command words
- write enough discrete statements to match the number of marks allocated to the question
- plan your response before committing pen to paper linking ideas in a clear and concise manner
- show working in mathematical responses, it may help you pick up marks
- consider mathematical concepts such as significant figures and decimal places.

Grade Boundaries

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