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Examiners' Report
Principal Examiner Feedback

October 2020

Pearson Edexcel International Subsidiary / Advanced Level
In Biology (WBI12)
Paper 01 Cells, Development, Biodiversity and Conservation

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Introduction:

This paper tested the knowledge, understanding and application of material from the topics ‘Cell structure, Reproduction and Development’ and ‘Plant Structure and Function, Biodiversity and Conservation.

The range of questions provided ample opportunity for students to demonstrate their grasp of these topics and apply their knowledge to novel contexts.

The questions on this paper yielded a wide range of responses and some very good answers were seen. The paper appears to have worked very well with all questions achieving the full spread of marks.

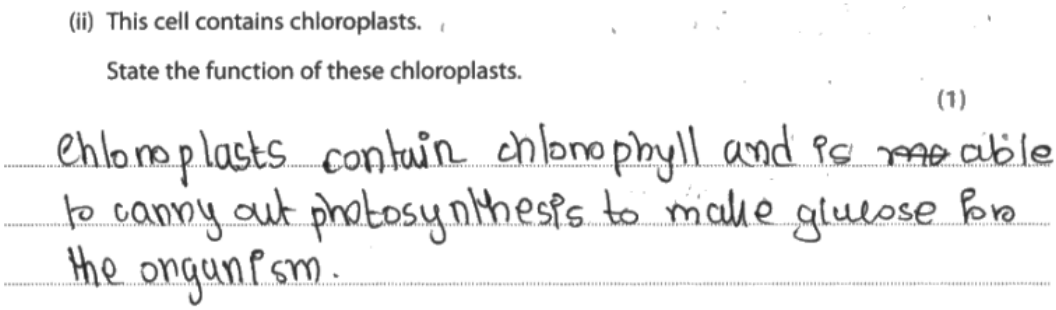
Question 1(a)(i-iii)
These were multiple choice questions on starch and cellulose. More students answered the starch questions correctly than the cellulose question.

Question 1(b)
This question asked students to use the information in the photograph to help them to explain how the structures of cellulose and microfibrils increase the strength of a plant cell wall.
Occasionally long answers about the structure of just cellulose were seen, with no reference to microfibrils.
The majority of students were able to describe the hydrogen bonds between adjacent cellulose molecules or that the microfibrils were arranged in a criss-cross pattern. However there were a small number of students who confused cellulose molecules and microfibrils.
A number of students discussed the role of pectin/hemicellulose or lignin which was not required for this particular question.

Question 2(a)(i-ii)
These were multiple choice questions on cell walls and cell membranes. The mojority of students were able to correctly identify that all three cell types contained a cell membrane, but that animal cells do not contain a cell wall.

Question 2(b)(i)
Students were required to correctly measure the diameter of the cell in order to calculate the magnification. It was disappointing that a significant number of students were not able to convert units correctly or recognise that magnification does not have the unit µm.

Question 2(b)(ii)
The majority of students were able to give a correct chloroplast function. A minority of students did not develop their answers beyond stating that chloroplasts contained chlorophyll.
This is an example of a correct response:


(ii) This cell contains chloroplasts.

State the function of these chloroplasts.

(1)

Chloroplasts contain chlorophyll and is ~~***~~ able to carry out photosynthesis to make glucose for the organism.

Question 2(b)(iii)
It was clear that the majority of students looked carefully at the diagram before answering this question.
This is an example of a correct response:

(iii) This cell is not a prokaryotic cell as it contains chloroplasts.

Give **one** other reason why this organism is not a prokaryotic cell.

(1)

It has a nucleus. Prokayotic cell has no nucleus, it has a loop of DNA.

Question 2(c)

This question provided students with a photograph of two adjoinging plant cells. The students were required to identify that the part labelled X was a plasmodesma and state its function.

It was disappointing that a significant minority of students could not identify the plasmodesma correctly. However, ECF could be applied for pits, cell wall and middle lamella. The must commonly awarded mark for the middle lamella was for joining adjacent cells together. The most common reason for losing marks was for referring to 'nutrients' being transported which was too vague at this level.

A minority of students lost marks here because they described the structure instead of explaining the function.
This is an example of a correct response:

(i) Name the part labelled **X**.

(1)

Plasmodesmata

(ii) Explain the function of the part labelled **X**.

(2)

The part labelled x is the plasmodesmata which is cytoplasmic connections between two plant cells. Plasmodesmata allow plant cells to communicate with each other. Substances like hormones ~~hormones~~ and other substances pass through these pathways.

Question 3(a)(i)

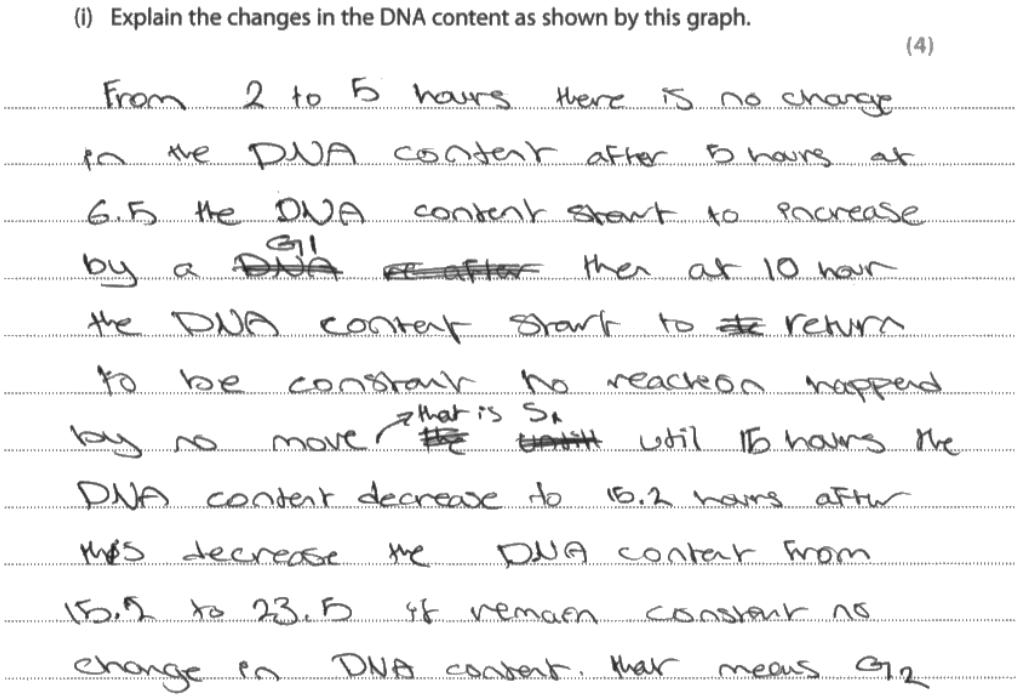
The majority of students correctly ordered the stages of mitosis.

Question 3(b)(i)

Students were given a graph showing the change in DNA content of a cell during one cell cycle. Students were asked to explain the changes in the DNA content.
This question differentiated very well, with the higher scoring responses demonstrating the students secure knowledge of what happens in interphase, mitosis and cytokinesis. The most commonly awarded marking points were 2,3 and 4. Where students did not gain the last marking point, it was mainly for not

explaining why the DNA content had reduced back to 2a.u. References to 2 identical daughter cells were too vague at this level.

However a significant minority of students did not take note of the command word **explain** and gave non-credit worthy descriptions of the changes in the DNA content as shown in this example:

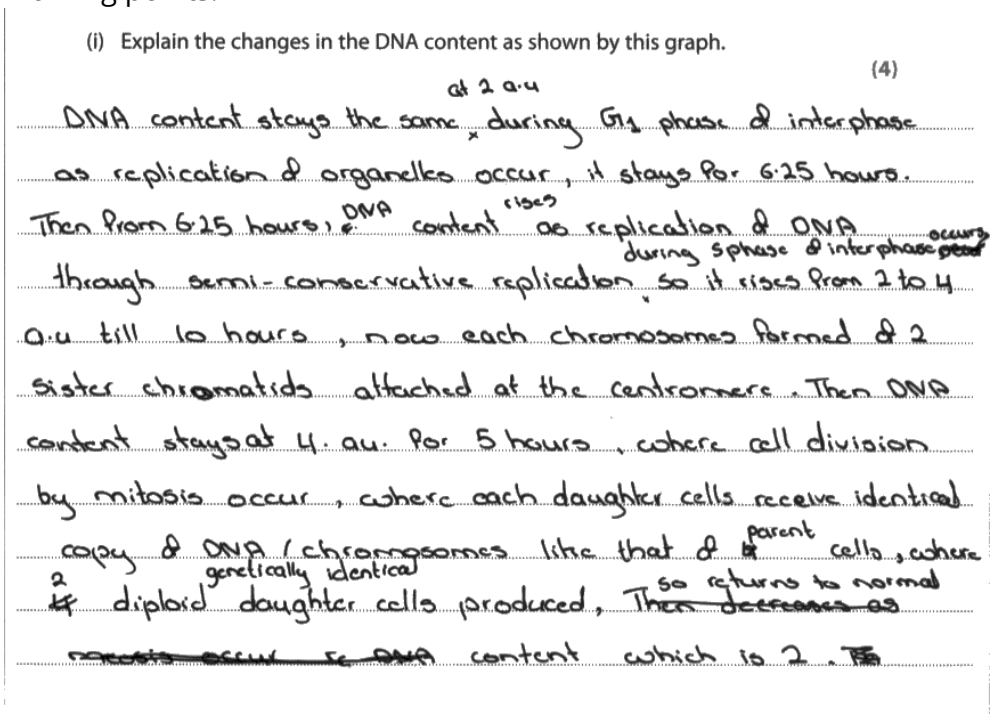


(i) Explain the changes in the DNA content as shown by this graph.

(4)

From 2 to 5 hours there is no change in the DNA content after 5 hours at 6.5 the DNA content start to increase by a ~~DNA~~ G1 ~~after~~ then at 10 hour the DNA content start to ~~it~~ return to be constant no reaction happend by no move ~~it~~ that is S1 ~~until~~ util 15 hours the DNA content decrease to 15.2 hours after ~~this~~ decrease the DNA content from 15.2 to 23.5 it remain constant no change in DNA content. that means G2

Whereas this response gained full marks and addressed all of the possible marking points:



(i) Explain the changes in the DNA content as shown by this graph.

(4)

DNA content stays the same at 2 a.u during G1 phase of interphase as replication of organelles occur, it stays for 6.25 hours. Then from 6.25 hours, i.e. DNA content rises as replication of DNA occurs during S phase of interphase through semi-conservative replication, so it rises from 2 to 4 a.u till 10 hours, now each chromosomes formed of 2 sister chromatids attached at the centromere. Then DNA content stays at 4. au. for 5 hours, where cell division by mitosis occur, where each daughter cells receive identical copy of DNA (chromosomes like that of parent cells, where 2 diploid genetically identical daughter cells produced, Then so returns to normal ~~decreases as nucleus occur i.e. DNA~~ content which is 2.

Question 3(b)(ii)

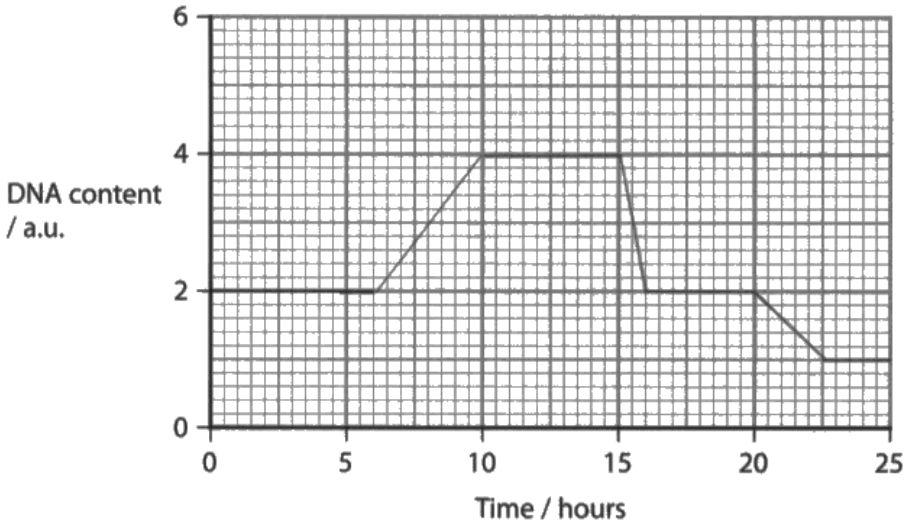
This question asked students to complete the graph to show how the DNA content would change if the cell had undergone meiosis to for gametes. It was expected that students would draw the same shaped graph as in Q3(b)(i), with a further division line to reduce the DNA content to the haploid DNA content (1 a.u.).

The majority of students were able to draw the same shaped graph, but did not recognise that meiosis would result in haploid cells.

Where students did reduce the DNA content to 1a.u., the most common mistake was to draw a line going directly from 4a.u. down to 1a.u., which lost the first mark.

This is an example of a response which scored full marks:

(ii) Complete the graph to show how the DNA content would change if the cell had undergone meiosis to form gametes.



Question 4(a)

This question required students to calculate the mass of fibre in the wheat bran of the grain of wheat in the diagram. The majority of students were able to do this successfully and correctly give their answer to **two** significant figures.

The most common mistake was not to give their answer to two significant figures, which resulted in the loss of a mark. Another common mistake was to not use the 14% of wheat bran labelled in the diagram.

Question 4(b)

This question required students to explain the advantages of using cutlery and plates made from wheat bran instead of oil-based plastics. Generally, students performed well on this question, with the majority correctly identifying that

wheat bran cutlery would be more sustainable and biodegradable. Fewer students included the the explanation of wheat bran products being carbon neutral or not contributing to global warming. The most common error was refer to pollution unqualified instead.

Question 4(c)

This question required students to explain the role of the pollen tube and nuclei in the formation of the endosperm nucleus. Although this question looked quite straightforward, students lost marks because they referred to the wrong nuclei.

Most students were able to explain that digestive enzymes enabled the growth of the pollen tube and that a triploid endosperm nucleus was formed.

This is an example where a student incorrectly referred to a generative nucleus fertilising the polar nuclei. They gained all of the other marking points however.

(c) The endosperm of a grain of wheat develops from the endosperm nucleus, formed during fertilisation.

Explain the role of the pollen tube and nuclei in the formation of the endosperm nucleus.

(3)

The pollen tube uses digestive enzymes to create a path for the generative ~~nu~~ nucleus which duplicates by mitosis. The pollen tube digests down the style into the ovary through the micropyle. One generative nucleus fertilises the ovum and the other the polar nuclei. When the polar nuclei and the generative nucleus fuse they form the triploid endosperm nucleus.

Question 5(a)(i)

This question required students to state what is meant by the term tissue. This was answered well, with the majority of students being able to give a credit worthy definition of a tissue, such as:

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

(1)

A group of similar cells working together to perform a specific function.

Question 5(a)(ii)

This question required students to use the given data and formula to calculate the mitotic index for patients P and R. They then had to determine that patient R was in a later stage of cancer than patient P.

It was pleasing to see that the majority of candidates were able to do this correctly and therefore scored full marks.

The most common error was not using the given formula correctly, e.g. not multiplying by 100 when they calculated their mitotic index. Another error was comparing the wrong patients.

Question 5(b)

This question asked students to compare and contrast the probabilities of survival for the different stages of a cancer.

Although many students were able to recognise the trends shown in the graph, some did not score well because they did not answer in the form of 'compare and contrast'. Separate descriptions of each stage were often given instead. To achieve high marks, the answer should be structured as clear similarities and differences and relate to each stage over the given time period. As there were three marks available, more able students realised that they were required to give more than one similarity and difference as demonstrated by this full marks response:

Compare and contrast the probabilities of survival for the different stages of this cancer, as shown by the graph.

(3)

All 3 stages show that as years after diagnosis passed the probability of survival decreased for the 3 of them. We can see how Stage 1 has the highest chance/probability of survived out of the 3 and Stage IV has the lowest probability of survival out of the 3 stages and also is the one that decreases more radically / the quickest

Students needed to recognise the similarity in the data was that the survival probability decreased over time for all three stages of the cancer. Many students did not state this similarity.

The most commonly awarded mark was for stating that stage I had the highest survival probability at the end of the time period whereas stage IV had the lowest survival probability.

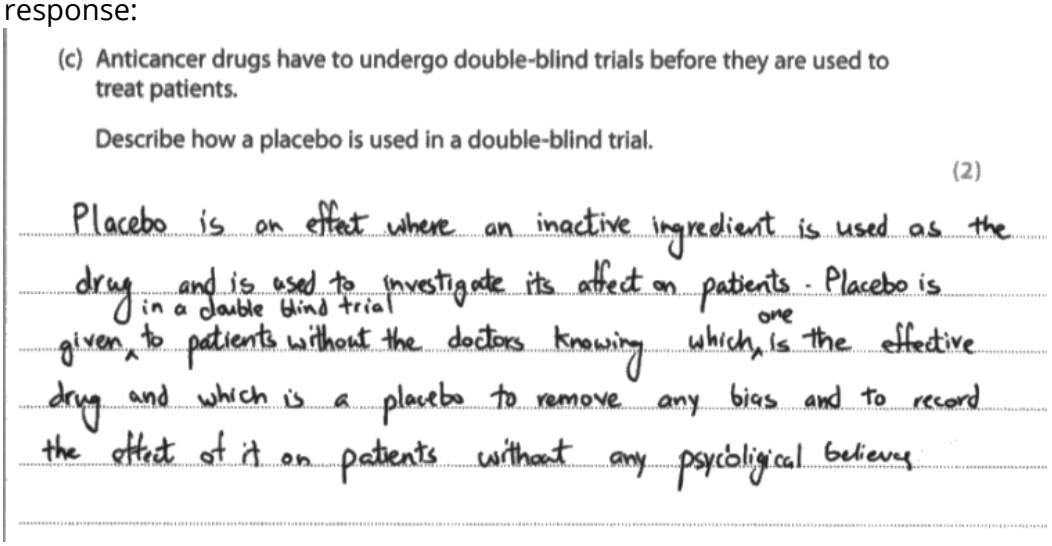
The lack of comparative language was a common reason why marks were lost, e.g. saying that stage IV had a steep decrease in survival probability.

Question 5(c)

This question related to how a placebo would be used in a double-blind trial. Some students did not recognise the use of the word 'how' in the question and explained 'why' the placebo would be used.

In answers which addressed 'how' the placebo would be used, students generally were able to gain the first marking point. The most common response was for stating what a placebo was, but there were some very good descriptions of how one of the groups in a drug trial would be given one.

A significant minority of students did not explain the double-blind aspect, whereas some students described a single-blind trial, as demonstrated by this response:



(c) Anticancer drugs have to undergo double-blind trials before they are used to treat patients.

Describe how a placebo is used in a double-blind trial.

(2)

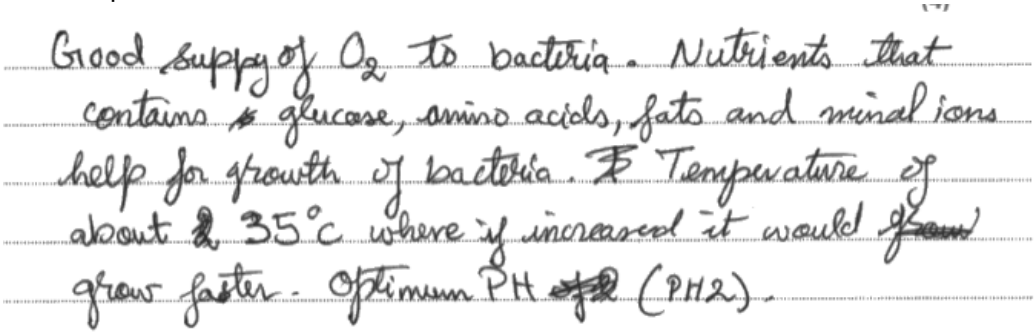
Placebo is an effect where an inactive ingredient is used as the drug and is used to investigate its affect on patients. Placebo is in a double blind trial given to patients without the doctors knowing which one is the effective drug and which is a placebo to remove any bias and to record the affect of it on patients without any psycological believe

Question 6(a)

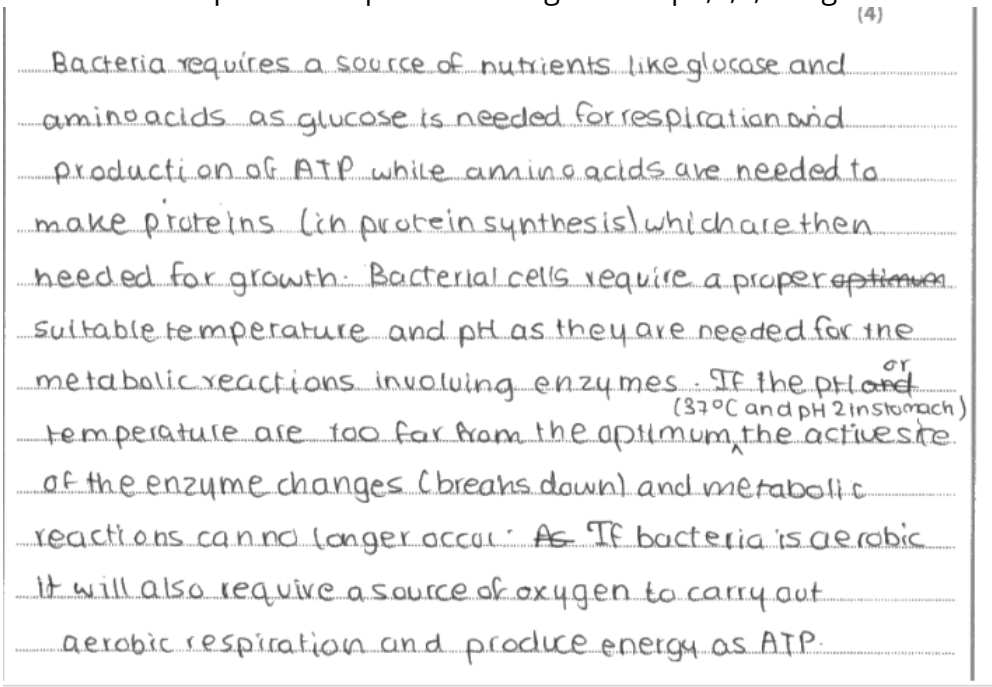
This question required students to explain the conditions needed for the growth of bacteria. Although they had been given information of a bacterium which can cause stomach ulcers, the question had been worded carefully to allow the descriptions of conditions for any bacterium.

It was clear that many students knew some conditions needed for the growth of bacteria.
However, many students did not take notice of the command word 'explain'. Just stating conditions needed for plant growth was not sufficient and was the most common mistake which lost students marks.

This response shows this common mistake:


Good supply of O_2 to bacteria. Nutrients that contains glucose, amino acids, fats and mineral ions help for growth of bacteria. Temperature of about 35°C where if increased it would grow faster. Optimum PH (PH2).

Where students did explain the conditions needed for growth of bacteria, the most commonly awarded marks were for oxygen or glucose being needed for respiration. Many students recognised that a suitable temperature or pH would be requred, but couldn't explain why. The explanation linking temperature and pH to the denaturation of enzymes were more commonly seen than explanations involving rate of metabolic reactions. Few students were able to explain why the bacteria would need water.
This is an example of a response which gained mp2,3,4,5 to gain 4 marks.


(4)

Bacteria requires a source of nutrients like glucose and amino acids as glucose is needed for respiration and production of ATP while amino acids are needed to make proteins (in protein synthesis) which are then needed for growth. Bacterial cells require a proper ~~optimum~~ suitable temperature and pH as they are needed for the metabolic reactions involving enzymes. If the pH ~~and~~ or temperature are too far from the optimum (37°C and pH 2 in stomach) the active site of the enzyme changes (breaks down) and metabolic reactions cannot longer occur. ~~As~~ If bacteria is aerobic it will also require a source of oxygen to carry out aerobic respiration and produce energy as ATP.

Question 6(b)(i)

This question asked students to calculate the percentage decrease in the mean areas of ulcer of the rats treated with omeprazole compared with the control rats with ulcer. The majority of students correctly identified which data needed to be used from the table and then calculated the correct percentage decrease.

The most common mistake was to divide by 95.71 instead of 802.71. Where students gave their working they could still have achieved one mark for 802.71-95.71=707. A small number of students lost a mark due to a rounding error.

Question 6(b)(ii)

This was the first of the levels-based questions and required students to use the information throughout the whole of question 6 in order to explain the results of the investigation.
It was expected that students used information about the function of the mucus, stomach providing all of the conditions required by the *H. pylori* and that the extract has antimicrobial properties in their answers.

Almost all students used the information from the table of data and achieved a level 1 by describing the trends in the data.

To achieve level 2, students needed to make a conclusion about the effectiveness of the treatments and give a simple explanation. Many were able to state the omeprazole was the most effective treatment and this, in addition to the description of the data, was the most common type of response for 3 marks.

To achieve level 3, students needed to develop their explanations and support them with sustained application of biological knowledge. Some high level responses were able to link antimicrobial properties reducing the numbers of *H. pylori* in the stomach to the corresponding descrease in damage to the stomach lining and resulting ulcer area. Some students built on the pH of the stomach aspect from 6(a) and suggested that the treatments changed the pH of the stomach to make it less suitable for *H. pylori.*

Question 7(a)(i-ii)

Both of these recall multiple choice questions addressed processes that occurred during meiosis and were well answered.

Question 7(b)

This question tested knowledge of linkage and proved more challenging for many students.

Students were given a table showing the percentage of total gametes produced with 4 different combinations of alleles. They were asked to explain why the percentages were not 25% for each combination of alleles.
It was surprising that the majority of students did not consider that linkage could be the reason. Many answers referred to mutation, dominant/recessive alleles and random assortment which were not credit worthy.

Where there was mention of crossing over, this was often vague and not related to the information provided.

There were some thoughtful and well-articulated answers which showed a good understanding of linkage and the given data, for example:

Explain why the percentages are not 25% for each combination of alleles.

(3)

Some alleles are more linkely to be inherited together than others. For example if genes A and B are linked, a chromosome having AB combination or ab combination is much more likely as the two genes are so close together on the chromosome that the probability of them being seperated by crossing over is very minimal hence AB combination and ab combination are more likely than the recombinants (aB and Ab) which happens as a result of crossing over.

Question 7(c)

This question required students to study the information and the diagram provided and describe how more than one protein can be synthesised from the RNA produced from one gene.

This question was a very good differentiator.

Students were expected to decribe RNA splicing and how different sequences of amino acids would be formed as a result.

A significant minority did not read the question correctly and gave a generic response for how a mutation would cause a different protein to be formed.

A significant number of students confused introns and exons. Some students gave deatiled descriptions of epigenetic modifications or how translation would occur which were not credit worthy.

The majority of students could correctly describe the removal of introns by enzymes and how the exons would be joined together. Some students could describe how these exons could be rearranged, or some exons were removed, before being joined together to gain a further mark. It was uncommon for students to use the information in the diagram to give two different permutations of exon order, e.g. QSUW and SQUW, but where this occurred it was usually in a high scoring response such as this one which scored 5 marks:

Describe how more than one type of protein can be synthesised from the RNA produced from one gene.

Use the information in the diagram to support your answer.

(5)

The DNA gets transcribed to the pre-mRNA which is simply a copy of the DNA. The pre-mRNA then undergoes DNA splicing where enzymes known as spliceosomes split up the pre-mRNA and removes the introns (the non-coding part of the DNA) and joins the exons (coding part) together to form the new modified mature mRNA which further goes on to produce a polypeptide chain. However, during the modification by splicing, exons can be left out as well. For example, QSUW can be formed from the pre-mRNA, but 'S' can be left out and QUW can be formed, or SUW, and other such various combinations. These different combinations give rise to different polypeptides and thus, one gene can synthesize many proteins based on the various combinations created during

Question 7(d)

This question required students to comments on the changes in activity of the two genes.

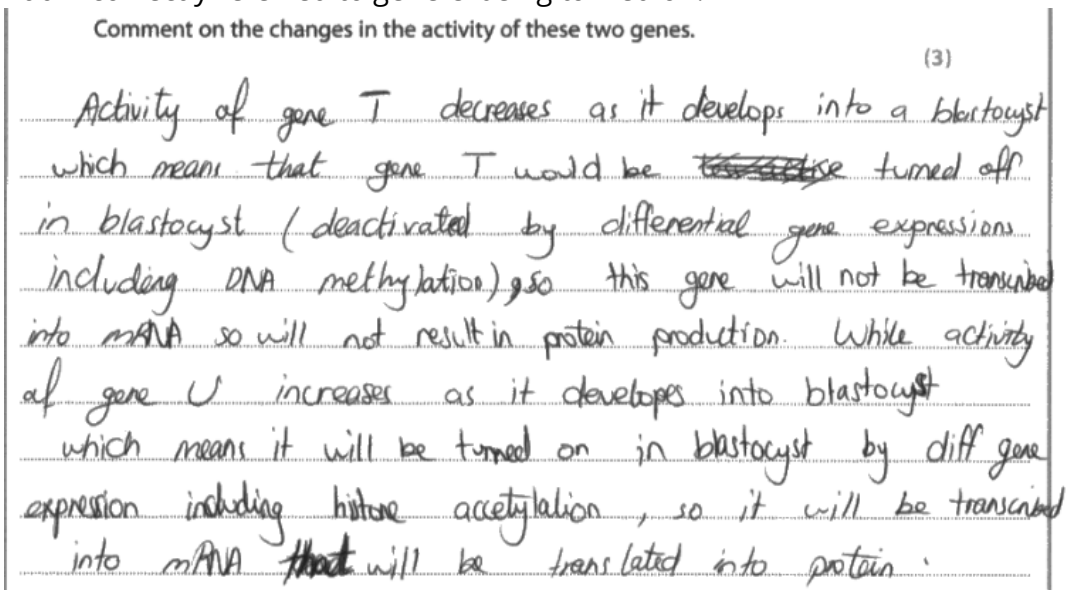
They were provided with a graph showing the change in gene T activity from zygote stage to blastocyst stage and were expected to describe the decrease in activity after the 8-cell stage. They were also provided with a graph showing the change in gene U activity from zygote stage to blastocyst stage and were expected to describe the increase in activity after the 8-cell stage. Nearly all students were able to give a description of the graphs. It was pleasing to see many responses with a clear comparative statement on the changes in activity of the two genes.

Some students did not expand on the descriptions of the graphs and were therefore limited to max 1 mark.

Where students did form a judgement as to why there was a change in the activity of the two genes, the most common response was to refer to the switching off of gene T. Some good descriptions of epigenetic modification were seen.

Fewer students were able to give a reason for why gene T was switched off, or why the activity of gene U increased. A significant minority referred to gene U

being activated as they had not recognised that it was already active at the zygote stage.
This is an example of a 3 mark response which gained marking points 1-3, but had incorrectly referred to gene U being turned on:


Comment on the changes in the activity of these two genes.

(3)

Activity of gene T decreases as it develops into a blastocyst which means that gene T would be ~~because~~ turned off in blastocyst (deactivated by differential gene expressions including DNA methylation) so this gene will not be transcribed into mRNA so will not result in protein production. While activity of gene U increases as it developes into blastocyst which means it will be turned on in blastocyst by diff gene expression including histone accetylation, so it will be transcribed into mRNA that will be translated into protein.

Question 8(a)(i)
This question required the students to study the photograph and relate the features they could see to the information given regarding the albatross.
The most common mistake by students was to state an anatomical adaptation without relating it to the information given. Some vague responses stating that it had wings were seen for example, which were not creditworthy at this level.
The higher level responses linked the long wings enabling gliding/flying over long distances, webbed feet to allow paddling, long beak to being able to reach the food source in the water. Descriptions of the webbed feet were often seen and were accepted if in a correct context.
Few students commented on eye size.

Question 8(a)(i)
This question asked the students to calculate the predicted albatross population after one year. This question was very well answered, with a significant majority of students understanding how to calculate a decrease of

5.3% as shown by this response:

(ii) It has been predicted that the population will continue to decline by 5.3% per year.

Calculate the predicted albatross population after one year. 4500

(2)

$\frac{5,3}{100} \times 4500 = 238,5$

$4500 - 238,5 = 4261,5$

Answer 4262

The most common mistakes made by students was to give the unrounded population, or to fail to subtract the decrease from the 4500, which limited them to 1 mark.

$\frac{4500}{100} \times 5.3$

$= 238.5$

Answer 239

Unfortunately some students failed to show their working, so if their answer was incorrect they were not able to access mp1.

Question 8(b)

This question asked students to suggest why the Tristan albatross and the wandering albatross were once classified as the same species.

A few students thought that they were classified together because they were in the same genus, showing a lack of understanding of classification.

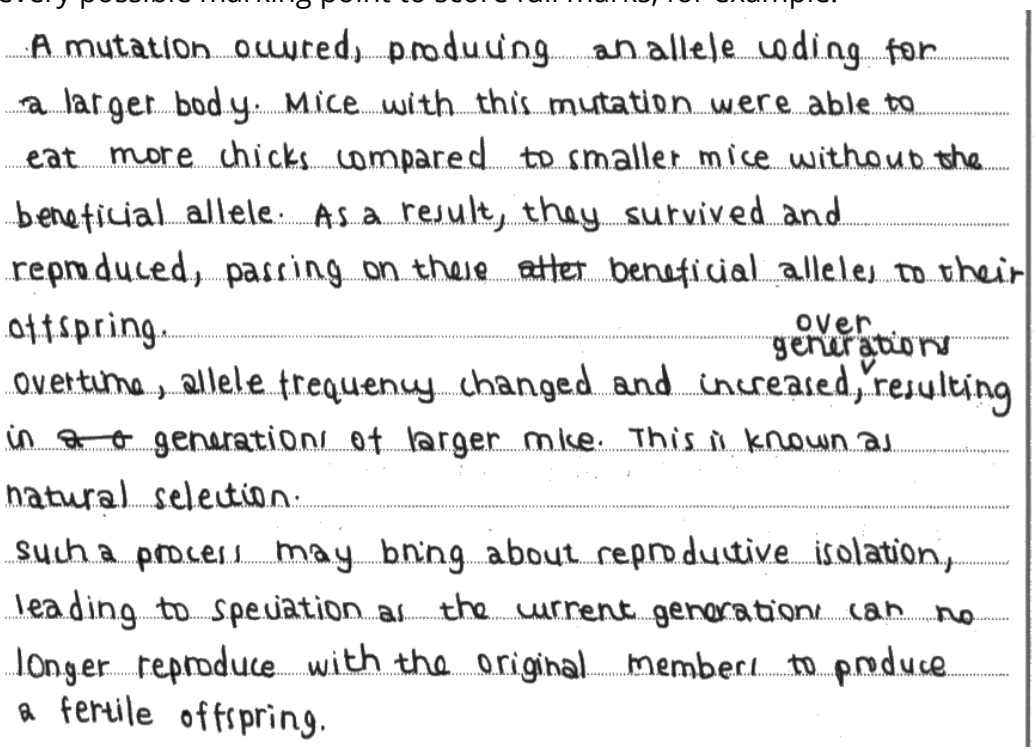
Some students grasped the idea that morphology was used to classify in the past, but failed to express that the birds were once classified as one species because of their SIMILAR morphology. The word phenotype was rarely used; the mark was much more frequently given for using the phrase 'similar morphology or similar physical features'.

Question 8(c)

This question asked students to suggest how the mice on the island have evolved to become a new species.

Generally students were able to give a good answer describing how a new species would evolve, but a generic response was limited in the number of marks that could be awarded. It was important for students to apply their knowledge to the given context of mice on the island who were 50% larger than normal mice.

Nearrly all students recognised that a mutation would have occurred and those with the mutation were more likely to survive and reproduce. A few students however, gave a more Lamark theory type response.
It was pleasing to see that a majority of responses recognised that the mice on this island were geographically isolated.
However, imprecise terminology did limit the awarding of marking points two and four as some students referred to genes instead of alleles.
Some students gave detailed answers related to the given context and covered every possible marking point to score full marks, for example:


A mutation occured, producing an allele coding for a larger body. Mice with this mutation were able to eat more chicks compared to smaller mice without the beneficial allele. As a result, they survived and reproduced, passing on these ~~after~~ beneficial alleles to their offspring. Overtime, allele frequency changed and increased over generations, resulting in ~~a~~ ~~o~~ generations of larger mice. This is known as natural selection.
Such a process may bring about reproductive isolation, leading to speciation as the current generation can no longer reproduce with the original members to produce a fertile offspring.

Question 8(d)

This was the second of the level-based questions on the paper.
Students were told that scientists have suggested some conservation strategies involving the island and some involving zoos in other countries.
Students were asked to explain how the Tristan albatross could be conserved and they were told to use the information in Question 8 to support their answer.
When students are told to use information in Question 8, this applied to all parts of Question 8, and not just Q(8)(d).
Students were expected to use the problem of predation by mice and the fact that the albatross is critically endangered in their responses.
It was clear that students knew the role of zoos in conservation of endangered species. Some high level descriptions of the use of studbooks and birds currently held in zoos, in captive breeding programmes were seen in order to increase population size, without decreasing genetic diversity.
Fewer students were able to explain how conservation strategies on the island would aid the conservation of this albratross species and this limited the marks that could be awarded.
Level 1 could be achieved by describing one strategy that could be used on the island and one that could be used in a zoo, but not explaining how the strategy would aid conservation of the albatross. More commonly this level was awarded for describing and explaining how captive breeding could be used to increase the population of the Tristan albatross.

To achieve level 2, students needed to describe and give a simple explanation of how the strategies used on the island and in a zoo could conserve the Tristan albatross. More commonly this level was awarded for describing and explaining how captive breeding could be used to increase the population of the Tristan albatross and then stating that there would be a reintroduction program. A higher scoring level 2 response would also explain an island based conservation strategy.

To achieve level 3 students had to describe and explain both types of conservation strategy, but to extend their explanations to include the maintenance/increase in genetic diversity and how to increase the survival chances of reintroduced birds. This is an example of a level 3 response:

Use the information in Question 8 to support your answer.

(6)

The population of the Tristan albatross needs to be increased. To do this the habitat and niche of the albatross need to be conserved. A conservation strategy on the island where the mice are fauna would be decreasing fishing to ensure the bird has enough food to breed. Creating conservation parks on the island to prevent from poaching of the bird.

Zoos in other countries could help by doing breeding programs to increase population size. Keeping breeding records and studbooks to prevent inbreeding and genetic drift. Switching albatrosses between zoos to prevent inbreeding. Having a reintroduction program so the birds return to the wild.

Killing some of the mice on the islands or having mice free zones to protect albatross chicks from predation. Having chicks grow away from mice.

Paper summary

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

- Read the whole question carefully, including the introduction, to help relate your answer to the context asked. You should take into account the command words as well as the context given. Answers which do not match the command words ot do not relate to the given context will not gain high marks.
- Do not try and make a mark scheme you have learnt from a previous paper fit a different question with different context and command words.
- Answers often require comparative statements, particularly when describing graphs or changes, so make sure that you are using comparative words, e.g. faster, more slowly, less often etc.
- Study the mathematical skills which could be tested and make sure you include your working with all calculations. Give relevant units where applicable. If rounding is necessary, make sure that this is done correctly.
- When asked to compare and contrast, make sure you have included both similarities and differences in your answer.

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