



Pearson
Edexcel

Examiners' Report
Principal Examiner Feedback

January 2020

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

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Publications Code WBI12_01_2001_ER

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Introduction:

This paper was the third of the new specification and 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. Very few questions were left blank and there was no evidence in the vast majority of papers that students had insufficient time to complete the paper. For example, nearly all students wrote lengthy answers to the last question on the paper.

There were some straightforward questions that yielded high marks across the ability range and some more challenging questions that discriminated well. There were many excellent responses which were clear and comprehensive, showing a good use of appropriate biological terminology.

It was clear that centres have been working hard to ensure their students study the mathematical requirements of this new specification. However, many students found it difficult to apply their knowledge to a given context, or to answer a question appropriately when supplied a particular command word.

Question 1(a)(iii)

This question asked students to state how ribosomes in prokaryotic cells are different from those in eukaryotic cells.

This was a direct recall question and the majority of students gave a correct answer. The most common response was to state that ribosomes in prokaryotic cells are 70S and that ribosomes in eukaryotic cells are 80S. It was important that a statement was made about each type of ribosome for this type of response. A minority of students stated that 'prokaryotic are 70S'. This was not sufficient as it did not state how they are different to eukaryotic.

A minority of students stated that prokaryotic ribosomes were smaller (than those in eukaryotic cells). This was a comparative response and was therefore awarded the mark.

Some high level responses were also seen, where the students recognised that eukaryotic cells contained both 70S and 80S ribosomes whereas prokaryotic cells only contained 70S ribosomes. Some students even extended their answer to include where the 70S ribosomes would be located in a eukaryotic cell.

Question 1(b)

Students were asked to state one function of a capsule and one function of a flagellum. In general, the vast majority of students could correctly state the function of a flagellum. However, there were fewer students who could give a correct answer for the function of a capsule. Often they gave an insufficient response, e.g. the capsule 'provides protection', without giving details about what the capsule is providing protection from. Occasionally they gave an incorrect response followed by a correct response. As the question had asked students for ONE function, this meant that the list rule had to be applied and their first answer was marked.

Question 2(a)

This question gave students a diagram showing three structures that formed after the fertilisation of an egg cell. One of the structures was labelled as a morula. The students were asked to explain why the cells in the morula are genetically identical. The majority of students were able to explain that the cells were genetically identical because they had divided by mitosis, however this was not sufficient to gain two marks. Students are to be encouraged not to just repeat information given to them in the stem of the question, but to use it to give greater depth to their answers.

Students were expected to refer to replication of DNA to ensure that each daughter cell could receive one identical copy of each chromosome after cell division had occurred, however, only a minority of students achieved marking points 2 or 3.

Question 2(b)(i)

Students were asked to name the structure labelled 'A' on the diagram. A significant number of students were not able to recognise that the structure was a blastocyst and a large number of responses gave the answer 'blastocyte' which was not credit worthy.

Question 2(b)(ii)

This question gave the scenario of a patient who had suffered a severe heart attack which had led to the death of heart muscle cells. Students were asked to suggest why injecting pluripotent stem cells into damaged areas of the heart muscle may benefit them.

There were two main ways that students gained the first marking point. Some students defined what a pluripotent stem cell was, whereas others explained that pluripotent stem cells could differentiate into heart muscle cells. The most common reason why marking point one could not be awarded was for the omission of differentiation / specialisation. Vague references such as 'giving rise to' or 'becoming' were not sufficient.

Fewer candidates were able to address how the patient would benefit from having the injection of these stem cells. Some excellent answers were seen where the students had considered how new heart muscle cells would enable the heart function to be improved to enable more oxygenated blood to be delivered to body cells. The idea that the dead heart cells would be repaired by this process was a common misconception.

Question 3(a)(i)

This question gave the scenario that the mass of Chinese white kidney beans varies due to polygenic inheritance. Students were then asked to state what is meant by the term polygenic inheritance.

The majority of candidates clearly understood that polygenic referred to 'many genes' or 'genes at different loci'. There were some students, however, who referred to 'many alleles for one gene' which was not credit worthy.

Fewer students were awarded the second marking point. One of the most common mistakes was for students to refer to characteristics (plural).

Question 3(b)(i)

This question asked students to calculate the predicted adult height of a daughter using the information given and the vast majority of students were able to do this correctly. A small minority of students, however, did not take note of the information provided and gave 161m as their answer which was not credit worthy unless they had changed the unit.

Question 3(b)(ii)

Students were asked to explain why the daughter may not grow to be 1.61m tall. This question proved to be very good differentiator. Marking points 1-3 were awarded in similar proportions to each other whereas few students achieved marking point 4. A significant minority of students did not consider that height / phenotype would also be affected by the environment.

The most common reason why a student was not awarded marking point 2 was for imprecision in the language used. References to balanced / unbalanced diet were too vague and not credit worthy. Some students wrote excellent responses linking lack of protein to reduced growth.

Question 4(a)(i)

This question asked students why the cells were stained in the investigation into the mitotic index of the tendril tip cells. Although this is linked to a core practical and the following questions also contained information, such as the photograph of the cells showing the stained chromosomes and a table showing the number of cells in each stage of the cell cycle, more than half of the students did not link the idea of staining to the context of calculating mitotic index correctly.

Many candidates said that the stain would be needed 'to make the cells visible' which was not sufficient. Other students said that the stain would be needed 'to make organelles visible'. This would not help identify the different stages of mitosis.

Question 4(a)(iii)

This question required students to calculate the mitotic index from the data given in the question and the majority of students knew how to calculate this. The most common error was to divide the number of cells in mitosis by the number of cells in interphase and a small minority of candidates were not able to add up the number of cells correctly.

Question 4(b)

This question asked students to suggest the advantages of tendrils for the pea plant. Many students went back to the beginning of question 4 and made note of the information they were given regarding tendrils and climbing plants such as peas. However, care must be taken to not just repeat information provided as this would not be credit worthy.

At this level, students need to use their own biological knowledge and apply it to the information provided, as well as make links between different aspects.

An example of this was marking point one. A significant minority of students repeated given information that a tendril 'can coil around anything it touches'. It was expected that they would link that a tendril could coil around due to the information that the pea plant is a climbing plant.

The higher scoring students then developed their answer to consider the benefit of this climbing behaviour to the pea plant. An increased use of comparative language was seen here.

Common misconceptions were that the tendrils would coil around prey, used for defence or that the pea plant was carnivorous.

Question 4(c)

This question asked students to explain how the separation of chromosomes in meiosis gives rise to genetic variation in the offspring of pea plants. It was clear which students had read the question carefully. It seemed that some students misread the question and did not take note of the phrase 'separation of chromosomes'. As a result, they gave general answers about how meiosis results in genetic variation. Information in these answers regarding crossing over in meiosis was not relevant to the question asked and therefore were not credit worthy.

By not reading the question carefully, many students wasted time giving irrelevant information to the question asked. Where students did give information relevant to the question, it was usually to name independent assortment. Many students did not explain how independent assortment would result in genetic variation in the gametes and the majority of candidates did not pick up on the use of the word 'offspring' in the question, neglecting to provide any information relating to the third marking point.

Question 5(a)(i)

Students were given some information regarding a Madagascan pygmy kingfisher. They were asked to state what is meant by the term endemic with reference to this kingfisher. Nearly all students knew the meaning of the term endemic but not all students related the meaning to the given context of this kingfisher.

Question 5(a)(ii)

This question asked students to name the domain in which the kingfishers would be classified. The majority of students were able to give the domain Eukarya but a significant minority gave the kingdom of Animalia instead. Other common incorrect answers included vertebrate or bird.

Question 5(b)(i)

Students were given two diagrams to analyse. The first was an old classification of five species of kingfisher and the second was a proposed reclassification of the same five kingfishers. Students were asked to use the proposed reclassification diagram to explain which species of kingfisher are most closely related to *Ceyx madagascariensis*.

Some students used the wrong diagram and therefore gave an incorrect answer which scored 0 marks. Where students understood the correct diagram, it was common for marking point one to be awarded. A small minority of students only gave one species (*Alcedo leucogaster*) which meant that marking point 1 could

not be awarded, but often they provided give a correct explanation to gain the second marking point.

A common mistake was to refer to sharing a common ancestor. All of the five species of kingfisher shared a common ancestor so this was not credit worthy for the second mark. Students needed to refer to the most recent common ancestor or another acceptable explanation.

Question 5(b)(ii)

This was the first levels-based question on the paper and proved to be a very good differentiator, with the full spread of marks seen. There were two aspects to the question and students needed to address both aspects fully in order to achieve level three. Students were also advised to use the information in the photograph and both diagrams to support their answer.

Firstly, students needed to explain how molecular evidence led to the reclassification of species. The best answers explained how the kingfishers were classified originally. They used information from the photograph and the first diagram to support their explanation. For example, 'the Madagascan kingfisher was originally classified as more closely related to the other *Ceyx* kingfishers. This was probably due to similar phenotype e.g. beak shape.' This covered information from two sections of the indicative content.

The students then explained how they were reclassified. For example, 'the scientist used molecular phylogeny and studied DNA sequences of the kingfishers and looked at similarities and differences. The ones with more similarities were more closely related to the Madagascan kingfisher. So the scientist moved the Madagascan kingfisher to the same branch as the *Alcedo* kingfishers'. This covered information from two more sections of the indicative content. If students had done this then they would have already achieved level 2 and 4 marks.

Students then needed to address the other aspect of the question. A minority of students did not do this, but generally this was the aspect of the question that was answered well. Students needed to explain how the scientist would propose the reclassification. Common answers referred to peer review or publishing in a journal and explained how the the scientific community would repeat the experiments or collect more data for analysis. A very small minority of students referred to statistical analysis of data. This covered information from the final two sections of the indicative content.

The most common mark total awarded for this question was three marks. Here, it was usually for section three from the indicative content, followed by sections five and six.

Question 6(a)(i)

Students were asked to label the xylem and phloem on the diagram. The majority of students were able to label both the xylem and phloem correctly. However, where it was not labelled correctly, the common reasons were: label lines touching the centre line of the vascular bundle or the xylem line touching the phloem location (and vice versa) or ambiguous labelling which could not be given credit.

Question 6(b)(i)

Students were given information about an investigation into water stress. They were given a table of data and asked to calculate the percentage decrease in the mean diameter of the fibres from plants in row 2 compared with those from plants in row 1.

It was surprising that some students did not extract the correct data from the table. The students had been asked to use mean diameter so answers using the SD were not appropriate. The most common mistake was similar to previous questions where students have been asked to calculate a percentage change. Students divided by 21.62 instead of 26.95 and were therefore limited to 1 mark. It is worth noting that on a different type of question students would be expected to give their answers to the same number of decimal places as the data provided.

Question 6(b)(ii)

This question required students to comment on the results of this investigation. It was clear which students understood what was required for the command word. 'Comment on' requires the synthesis of a number of factors from data / information to form a judgement. More than two factors need to be synthesised.'

Students who only used the data in the table and not the information about water stress above the table were therefore limited in the number of marking points they could access.

The majority of candidates were able to describe the trend shown by the data in the table to gain marking point 1. Many students used all of the given space by repeating information from the table.

As this question was near the end of the paper, students were expected to recognise the significance of overlapping or non-overlapping SD. Comments on the size of the SD values were not credited here.

In order to access marking points 3 and 4, students needed to synthesise both the water stress information and the investigation results to form a judgement. These marking points were targeted at the higher grades.

Question 6(d)

This question asked students to explain how xylem vessels are adapted for support and transport. Students were provided with answer space for each the majority took note of this, separating their answers accordingly.

The most common mistake made in the support explanation was the omission of lignified walls of the xylem / secondary thickening. The majority of students knew that this lignification provided strength.

The most common mistake made in the transport section was to state that the xylem vessels were hollow with the omission of the detail of no {end walls / cytoplasm}. Most students explained the pits or lignin adaptation correctly to gain both marks.

Question 7(a)(ii)

The students had been given two electron microscope photographs from a beta cell. The bottom photograph showed two labelled mitochondria and the students were asked to suggest why they looked different.

A surprising number of students thought that the mitochondria looked different due to different magnification, resolution or staining. As they were on the same photograph this was not a credit worthy suggestion.

Where students did give a credit worthy response, it was often fulfilling either marking point 1 or 3 only. Only a small minority of students correctly recognised that the cell / mitochondria would have been cut in order to create the specimen used in the electron microscope.

Question 7(a)(iii)

This question gave the students the image size and the actual size of the mitochondria labelled U. Students were asked to calculate the magnification. It was surprising that the majority of students did not calculate the magnification correctly.

One common mistake included incorrect unit conversions. Many students did not know how to convert mm into μm . Many answers were given to an incorrect power of 10. Another common mistake was to place the given numbers in the wrong place in the equation. A small minority of students gave a unit e.g. μm . This was not appropriate and caused the loss of a mark.

Question 7(b)

This question continued the scenario of insulin producing beta cells.

Students were asked to describe how the insulin protein is transported from the ribosomes and then secreted by a beta cell.

This question was a very good differentiator and the full range of marking points were awarded. The highest scoring students read the question carefully and

took note of the key aspects. They referred to the given protein insulin instead of just referring to protein unqualified and did not explain how translation occurred as they had taken note of 'transported from the ribosomes'.

Marking point 2 was less frequently awarded. This was targeted at the higher ability students and few students met all aspects of the marking point. The majority of students referred to vesicles moving to the Golgi apparatus and then the protein being modified by the Golgi apparatus without consideration of how the insulin protein was transferred from the vesicle into the Golgi apparatus.

It is worth noting that, as in previous papers of this new specification, that general answers which are not applied to the given context will not access many marking points and therefore students are encouraged to read the information they are given very carefully.

Question 7(c)

This question asked students to explain why beta cells can produce insulin but other cells in the pancreas do not. This question was also a very good differentiator and the full spread of marks and marking points were awarded. Less able students tended to focus on that the gene in the beta cell was switched on and the cell was specialised. These type of responses often suggested that the gene in other cells was switched off but did not explain how the gene.

Higher scoring answers related their answer to the given context and explained how genes were switched off in other pancreas cells. They also explained how an active gene in a beta cell could result in the production of insulin. For example, 'the beta cells can produce insulin because they are specialised for this function and have the gene switched on. Other cells have had the insulin gene silenced through epigenetic modification as methyl groups have been added. mRNA is made from the active gene in transcription and it is translated into an insulin protein at the ribosomes'. This response scored full marks.

Question 8(a)(ii)

The students had been told that the biodiversity of the National Park could be measured by calculating species richness. They were asked to describe **one** other way that the biodiversity of this area could be measured. It was expected that students would recall the specification point 4.17: 'know how biodiversity can be measured within a habitat using species richness, and within a species using genetic diversity by calculating the heterozygosity index'. This proved challenging for the majority of students. Unfortunately, many students explained how species richness could be measured, which was not credit worthy.

Another common mistake was to misread the question. They were asked about measuring biodiversity in 'this area' of the park and not how to compare

biodiversity in different habitats. A significant number of students described index of diversity as a result which was not credit worthy.

A significant number of students ignored the instruction to describe **one** other way and proceeded to give various methods. Only the first method was marked. However, there were some excellent responses which clearly described how to measure the genetic diversity and even gave a correct heterozygosity index equation.

Question 8(b)

This question told students that the numbers of saltwater crocodiles have decreased over the past 40 years. Students were asked to explain possible causes of this decrease.

Generally, students could state a possible reason but did not go on to explain why it would cause a decrease in the number of crocodiles. For example, a common answer would be to say deforestation without stating that it would cause habitat loss, or pollution in the river without linking it to the river becoming an unsuitable habitat or the pollution killing the crocodiles.

The most commonly awarded mark was the fourth marking point. Generally it was for either disease or hunting, but some responses were seen which had clearly taken note of the subsequent questions and had used the information in this answer. It was surprising that a number of students explained how the numbers of the crocodiles could have increased instead of decreased.

Question 8(c)(i)

This question provided students with a graph showing the effect of temperature on the percentage of crocodiles that hatch as male. Students were asked to use this information to calculate the number of female crocodiles that would develop from 350 eggs incubated at 32°C.

The majority of candidates were able to read data from the graph correctly and their working showed the 23% male at 32°C.

Unfortunately, a small minority of students then used this number to calculate how many male crocodiles would hatch from 350 eggs. The majority of students however, were able to use the correct numbers to calculate the number that would develop. More able students understood that they should round the answer to a whole number as the question was in the context of a living organism; students who did not do this lost a mark.

Question 8(c)(ii)

This question was the second levels-based question on the paper.

Students were asked to explain how this project could increase the number of crocodiles rapidly, without reducing the genetic diversity of future populations in Bhitarkanika National Park.

The students needed to use the information from the previous page, both graphical and text, in order to answer this question.

The strongest responses took note of the key ideas of the question. They explained how the population could be **rapidly** increased by recognising that the eggs should be incubated at temperatures which would result in more females hatching than males. They further developed this idea by explaining that more females would mean more eggs / offspring in the next generation(s) which would result in a quicker population rise.

Level 3 could only be achieved by students who not only addressed the rapid increase but also the maintenance of genetic diversity. There were some excellent responses which recognised that too few males would reduce the genetic diversity of offspring and that the genetic analysis could be used in conjunction with stud books to prevent inbreeding of future populations.

The less detailed responses did not refer to the maintenance of genetic diversity or select a temperature which would give more females. Instead these answers either chose 31°C which was an inappropriate temperature, or did not use any information from the graph.

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 or do not relate to the given context will not gain high marks.
- Do not try to make a mark scheme you have learnt from a previous paper fit a different question with different contexts and command words.
- Ensure you use the correct technical names and terms in your answer. For example, do not refer to genes when you should be referring to alleles.
- Study the mathematical skills which could be tested and make sure you include your working with all calculations. Give relevant units where applicable.
- Take note of the number of decimal points used in the data provided as answers may require the answer to be given in the same format.

