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Examiners' Report

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Pearson Edexcel International Advanced Subsidiary Level in Biology

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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)

This question asked candidates to name the stage of mitosis shown in the photograph. Most candidates could identify that this was anaphase.

However, some candidates mistakenly thought it was either telophase or metaphase. Some candidates did not take careful note of the word mitosis in the question, and they wrote down a meiosis stage.

Question 1(a)(ii)

This question asked candidates to describe what happens during the telophase stage of mitosis in a plant cell.

A small number of candidates confused telophase with prophase or cytokinesis.

Some excellent responses were seen giving a higher level of detail in their description. Many candidates knew what would happen to the chromosomes, nucleus, nucleolus and nuclear membranes. Many candidates also knew that the spindle fibres would break down.

A small number of responses gave excellent detail of the formation of the cell plate.

Question 1(b)(i)

This question gave candidates a table of information regarding stains and the molecules that they stained.

Candidates were asked to identify which slide would provide the student with the information needed to observe cells in mitosis.

Most candidates could identify that it would be slide A with a safranin stain. Most candidates could also give a correct reason for their answer using the information in the table and applying it to their own knowledge. Candidates were expected to recall that DNA / chromosomes are composed of nucleic acids.

Candidates did which did not apply their own knowledge did not gain the mark.

Question 1(b)(ii)

This question asked candidates to calculate the mitotic index and compare it to the four distractors in the multiple-choice question.

Most candidates were able to select the correct answer. The most common mistake was including the interphase data in the calculation.

Question 2(a)(i)

This question asked which parts of a plant cell store starch. Most candidates understood that the amyloplast stored starch, but fewer candidates remembered that the chloroplasts also store starch.

Question 2(a)(ii)

This question asked candidates to describe the structure of starch.

Many excellent descriptions were given showing the candidates good understanding of this part of the specification.

The most commonly awarded marking points were that starch contains amylose and amylopectin and the types of glycosidic bonds found in the molecule.

Some candidates mistakenly thought that starch was made of β-glucose.

Some answered a different question and described the properties of starch as a storage molecule.

A small number of candidates referred to amyloplast instead of amylopetin.

Question 2(b)(i)

This question asked candidates to state the function of a lysosome.

Unfortunately, some candidates stated the function of a ribosome which was in the previous sentence.

Where candidates did state the function of a lysosome, some excellent responses were seen, for example autophagy, apoptosis and destruction of worn-out cells and organelles.

Question 2(b)(ii)

This multiple-choice question tested unit conversion and ratios.

Candidates were told the diameter of ribosomes and lysosomes; they needed to convert nanometres to micrometres (or converse) and then decide which distractor was the correct ratio.

Where candidates recognised they needed to do a unit conversion, they were able to select the correct ratio.

Question 3(a)

This question told candidates that the bacteria in the river would reduce the oxygen content of the river water. They were also told that the bacteria in the river would digest the sewage. They were asked to suggest why the oxygen content of the river water is reduced by the bacteria.

Most candidates recognised that the oxygen would be needed for respiration but failed to give the detail of aerobic respiration. Some candidates stated that energy would be produced, which was rejected. Precision in terminology is required at this level.

Question 3(b)(i)

This question required candidates to calculate an index of diversity using the information in the table and the supplied equation.

It is important that candidates understand what the symbols in the equation represent.

Candidates were expected to recognise that capital N equalled 118 and that 6046 needed to go on the denominator part of the equation.

It is important to take careful note of information regarding the presentation of the answer. Some candidates calculated the index of diversity correctly but failed to give their answer to two significant figures and therefore could only gain one mark. Some candidates rounded their answer to 2 decimal places instead of to 2 significant figures.

Question 3(b)(ii)

This question asked candidates to suggest what effect the sewage entering the river would have on the biodiversity at sampling site B. Candidates needed to give a reason for their answer.

Most candidates suggested that the biodiversity would decrease and gained marking point 1. However, some candidates said that the biodiversity would change, without giving a direction for the change, which was not creditworthy for marking point 1.

Most reasons centred around loss of species richness or a decrease in species evenness. It was important that candidates were very clear in their descriptions, because referring to decrease in populations was not sufficient for this context.

Many candidates referred to reduction in oxygen content at B in their explanations, making good use of the information given in the question.

Question 4(a)(i)

This question provided candidates with a map showing the current and historical ranges for two endangered subspecies of tiger.

Candidates were asked to calculate the maximum width of the historical range of the extinct Caspian tiger. They needed to measure the width of the historical range and use the provided key to calculate an answer in kilometres.

Candidates are expected to have a ruler as part of their equipment for the examination. Many answers were seen within the required range and gained the mark. However, it was evident that some candidates measured the width of an incorrect part of the map and therefore their answer was not credit worthy.

Question 4(a)(ii)

This question asked candidates to give two reasons why the Caspian tiger subspecies is now extinct. Most candidates could give two creditworthy reasons why the Caspian tiger subspecies is now extinct.

Most answers centred around habitat loss or destruction and hunting.

Some answers centred around disease or less food being available for the tigers and a few candidates commented on the tigers' reproductive isolation and difficulty in finding a mate.

Question 4(a)(iii)

This question asked candidates to suggest why scientists have placed these tigers into different subspecies of the same species.

There were two parts to this question, why they are different subspecies, and why they are still in the same species.

Most candidates centred on just one part of this question, why they are different subspecies. Answers such as 'they show variation' were not creditworthy as they were given this information below the photograph.

Candidates should have applied relevant knowledge to explain what sort of variation these tigers may show, for example named differences in phenotype or genotype. Some candidates only described **similarities** in e.g. DNA in which would not explain why the tigers were placed in different subspecies.

Some candidates addressed the other part of the question and explained that they are in the same species because they can reproduce together to form fertile offspring. Viable offspring was not sufficient.

Some candidates misunderstood the question and gave answers explaining how or why subspecies should be interbred.

Question 4(b)

Candidates were asked to explain why creating links between populations of Bengal tiger would help maintain their genetic diversity. They were given the instruction to use the information on the map to support their answer.

Most candidates use the map to identify that the Bengal tiger was living in isolated areas so the populations would be isolated from each other, with some using relevant terminology such as reproductive isolation or geographical isolation.

Many answers were seen explaining that if links were made between isolated populations, then tigers could move between the populations and mate with others from other populations.

Marking point three was less commonly awarded, with some answers confusing the gene pool of separate populations with the gene pool of the species as a whole. Some candidates recognised that different populations may have different alleles, which would be introduced to other populations if links allowed mating between those populations. A number of candidates made incorrect statements about allele frequency, suggesting a poor understanding of the concept.

Some candidates used the terms gene and allele incorrectly.

Question 4(c)

Candidates were asked to describe how education could help conserve these endangered tiger subspecies. This was taken directly from the wording of the specification.

It was clear that some candidates had a good grasp of this specification point and gave detailed descriptions which gained full marks. Answers tended to centre around raising awareness of the importance of these endangered tigers in the food chain or ecosystem, protecting their current habitat and reducing the hunting of tigers.

Frequent mentions were also seen of breeding programmes and changing laws in the relevant countries.

Question 5(a)(i)

This question provided candidates with a photograph of bags and string made from fibres from jute plants.

Candidates were asked to give the name of a tissue that would be a source of jute fibres.

Most candidates could give one of the fibres named in the mark scheme. However, some candidates gave names of molecules or organs which were not creditworthy.

Question 5(a)(ii)

Candidates were asked to give one reason why these jute fibres have a high tensile strength.

Most candidates could give a correct answer here, with many answers focusing on the arrangement of the fibres or cellulose microfibrils. Frequent mentions of the hydrogen bonding between cellulose microfibres were also seen. Many candidates also referred to the high lignin content of these fibres.

Question 5(a)(iii)

Candidates were given the information that bags made from jute are more sustainable than bags made from oil-based plastics as they are renewable.

Candidates were asked to give one other reason why they are more sustainable than bags made from oil-based plastics.

Unfortunately, some candidates did not read the information in the question carefully and gave answers centred around the renewable aspect of the jute fibres, which were not creditworthy.

However, many answers were seen describing the biodegradable aspect of the jute fibres or the carbon neutral aspect.

Question 5(b)

Candidates were provided information regarding an investigation into the antimicrobial properties of extracts made from the leaves and seeds of jute plants.

It was important that candidates read and analysed the information carefully. Candidates were asked to deduce the effectiveness of the jute leaf and seed extracts. Answers needed to centre around the word 'effectiveness'.

Most candidates could analyse their table in the data to give answers covered by marking points one and two. However, some candidates just referred to the diameter of the zone of inhibition which was not creditworthy. A small number of candidates thought the bacteria was effective and not the extract.

Similarly to the previous exam series, it was important that candidates analysed the data carefully to see which standard deviations overlapped and which did not. Answers which did not give specific correct examples from the table regarding overlaps or non-overlaps and state the significance of this did not gain marking point 3.

Some candidates gave suitable comments regarding the methodology of the experiment to gain marking point 4.

Question 5(c)(i)

Candidates were provided with an information and flow chart regarding William Withering's drug testing of his digitalis soup. Candidates were asked to name the active ingredient in the extract that William Withering tested.

This proved to be a very challenging question for most candidates, although digitalis is a named aspect in the specification point.

Question 5(c)(ii)

This question asked candidates to describe how each step in William Withering's method of drug testing compares with contemporary drug testing.

This question was a very good differentiator.

Most candidates could correctly compare step one of the drug testing to contemporary drug trials. The most common aspects seen centred around pre-clinical testing.

In step 2, most candidates could correctly identify the comparison that modern drugs trials would first test on a small number of healthy people. Frequent mentions of testing on animals or human cells were also seen which also gained credit.

The step three comparison proved to be the most challenging for all but the most able candidates. Candidates needed to recognise that modern drugs trials would start with the lowest dosage first and then slowly increase the dose to find the lowest effective dose. References to using the lowest effective dose were not sufficient without a description of how the lowest effective dose would have been determined before testing on humans.

Most candidates could give a correct step four comparison between Withering's drug trial and contemporary drugs trials. Frequent mentions were seen to testing on larger numbers of patients with heart conditions, double-blind testing or uses of placebos for example.

Question 6(a)

This question asked candidates to explain why seeds are dried and then kept in dry conditions in a seed bank. It was clear that many candidates have a good understanding of this aspect of the specification with many excellent explanations seen.

However, there were some candidates who gave descriptions instead of explanations. It is important to take careful note of the command word.

Some answers did not use appropriate terminology, for example referring to seeds growing instead of germinating.

Most answers centred around preventing germination or reducing the growth of microbes on the surface of the seed. Frequent mentions of reducing enzyme reactions were also seen. Many candidates also considered that storage in these conditions would keep the seeds viable for longer.

Question 6(b)(i)

Candidates were asked which occurs during fertilisation to produce an embryo.

Most candidates could answer this multiple-choice question correctly and select the option where the male nucleus fuses with an egg cell nucleus.

Some candidates selected option D, confusing an embryo with an endosperm.

Question 6(b)(ii)

Candidates were asked to explain why some seed banks would choose to use cryopreservation.

It was important that candidates used and understood the information given at the start of part (b) in their answer. The question was centred around the context that seeds from some endangered plant species do not survive the drying process. Candidates were also given the information that cryopreservation involves removing the embryo tissue from the seed.

Many candidates could access marking point two however fewer candidates gave the level of depth in their answer or application to the given context to gain the second mark.

Question 6(c)

Candidates were given the information regarding an investigation. Candidates were told that the type of container used to store seeds can affect the percentage germination of seeds in a seed bank.

The graph provided showed the percentage germination of seeds kept in three containers: a cloth bag, a sealed plastic bag and a sealed metal can. Candidates were asked to comment on the results of the investigation and use the graph data to support their answer. It is important that candidates understand that they should use both variables in their answer.

Most candidates could comment that the storage in a sealed container was more effective than an unsealed container, or the storage in the sealed metal can was the most effective storage method to keep the germination percentage higher for longer. Most candidates could use the data in the graph to support this judgement.

Surprisingly fewer candidates could give answers describing that the percentage of seeds which germinate decreased with the increased storage time. Instead, they tended to focus on separate descriptions of each of the three containers, which were not creditworthy.

Some candidates commented on the fact that there were no repeats or information regarding the sample size, so they could not be fully certain of the validity of their judgments.

Question 6(d)

Candidates were provided with a diagram showing how new genetically identical plants can be grown using tissue samples from an endangered plant species. Candidates were asked to explain how tissue samples taken from a parent plant can develop into whole plants that are genetically identical. They were given the instruction to use the information in the diagram and their own knowledge to support their answer.

Some candidates gave detailed descriptions of how to carry out this procedure which failed to answer the question.

Most candidates knew that the tissue sample cells would divide by mitosis, and this was the most frequently awarded marking point. Some detailed descriptions of mitosis were seen which were not required for this question.

Many candidates commented that these new cells would be genetically identical but as this was very close to the wording in the question, they were not awarded marking point two. Candidates needed to explain how they would be genetically identical using their own knowledge, for example that they would have an identical DNA sequence.

Many candidates understood that the tissue sample would contain meristematic tissue and therefore these cells would differentiate into the new structures that had been labelled in the diagram.

Many answers contained the information that differential gene expression would occur with the activation of genes controlling the root or the leaf cell development.

Some candidates used the information that they were given in the diagram regarding the agar. They used their knowledge about which nutrients plants needed for healthy growth, but sometimes this was not at the required level. For example, answers which said that plants need nitrogen were not sufficient, the answers which explained that plants would need nitrates to form amino acids or proteins gained marking point six. It is important to be precise when answering questions regarding inorganic ions. Candidates needed to include the word **ions** when referring to magnesium ions being needed to form chlorophyll, and similarly for calcium ions being needed to form named molecules.

Question 7(a)

Candidates were asked to explain two ways in which the head of a human sperm cell is specialised for its function. It is important to recognise the command word, descriptions instead of explanations did not gain marks.

It was important that candidates read the question carefully and understood that they were being asked about the adaptations of the head of the sperm cell, Unfortunately, many candidates referred to the mid piece or the flagella of the sperm cell, which were not creditworthy.

Most answers centred around marking point three. Candidates explained why the head of the sperm cell contained an acrosome or acrosin enzymes.

Many explanations of the streamlined shape were also seen.

Although many candidates knew that the head of the sperm cell contained a haploid nucleus, few gave the explanation as to why.

Some detailed explanations were seen which included the aspect that the sperm cell had an antigen on the cell surface membrane of the head to bind to the receptors on the egg cell surface membrane, possibly picking up on aspects that were in the previous exam series.

Question 7(b)

Candidates were asked to calculate the volume of the egg cell in μm^3. They were given the diameter of the egg cell and the formula for calculating volume of a sphere. Candidates needed to perform a unit conversion on the diameter to change it from millimetres into micrometres, convert diameter to radius and then calculate the volume.

Consistently with previous exam series many candidates struggled with the unit conversion. Some candidates also use the diameter in the volume calculation instead of the radius.

Many candidates did use the correct values in the volume calculation, but they didn't give their answer in standard form. It is important that candidates read the information they're given very carefully.

Question 7(c)(i)

Candidates were given a diagram showing some cells produced during meiosis in a female organism. Candidates were asked to complete the diagram to show the chromosomes that would be found in the egg cell and the second polar body.

This proved to be challenging for many candidates. Many candidates did not understand processes which occur during meiosis II.

Many drawings were seen showing sister chromatids joined together by the centromere. Few candidates took careful note of the difference in size of the different chromosomes.

Question 7(c)(ii)

Candidates were given a diagram showing 2 secondary oocytes, A and B, that could have been produced from the primary oocyte because of meiosis I.

Candidates were asked to explain why these secondary oocytes, A and B, are genetically different from each other.

Most candidates understood that independent assortment of chromosomes had occurred.

However fewer candidates could explain why the chromosomes were different in the two cells. It is important that candidates understand the difference between an allele and a gene, as well as analysing the provided diagram carefully. The provided diagram did not show any evidence of crossing over or recombinant chromatids.

Question 7(d)(i)

Candidates were told that the gene Rab27A contains the genetic information for the production of the protein fibres which transport cortical granules to the cell surface membrane. They were provided information regarding an investigation into the effect of the activity of this Rab27A gene.

Candidates were asked to describe how the activity of a gene, such as Rab27A, could be altered.

Most candidates understood that epigenetic modification would alter the activity of the gene. Some excellent answers were seen with detailed descriptions regarding how this process would occur and including the detail of the binding of RNA polymerase or transcription factors.

Question 7(d)(ii)

Candidates were provided with a graph showing the results of an investigation. It was expected that candidates analyse the graph carefully to understand the results of the investigation.

Candidates which had read all the given information in all of part (d) carefully could analyse the graph correctly.

Some candidates did not recognise the use of the command word 'explain' and just described the data.

It was important that candidates used all the information that they had been provided with in their explanation. Some candidates understood that transcription and translation would occur to form the protein fibres when the gene was active in Group A.

High level answers explained that these protein fibres would transport the cortical granules to the egg cell membrane where exocytosis of cortical enzymes would occur. Many candidates understood that when the cortical that reaction occurs the zona pellucida would harden which would prevent polyspermy from occurring, with marking points five and six being the most frequently awarded marking points.

High level answers also understood that in Group B, where the gene had been deactivated, that these processes would not occur and that additional sperm cells would be able to fuse with the cell surface membrane of the egg and polyspermy would occur have as evidenced by the data in the graph.

Question 8(a)(i)

This multiple-choice question asked candidates which organelle can form secretory vehicles containing extracellular enzymes that fuse with the cell membrane. Most candidates could select the correct answer.

Question 8(a)(ii)

This multiple-choice question asked candidates which row showed the organelles that have or produce ribosomes. Nearly all candidates were able to identify that organelle P showed ribosomes on its surface in the diagram and therefore could discount distractors C&D. Many candidates could also identify that the nucleolus would produce ribosomes and were able to select the correct answer.

Question 8(a)(iii)

This multiple-choice question asked candidates which part of a cell would be involved in respiration. Nearly all candidates selected the correct answer mitochondria.

Question 8(b)(i)

Candidates were asked to name the stage in meiosis in which crossing over would begin. Nearly all candidates understood that crossing over occurred in prophase I. However, some candidates were not precise enough in their answers and just answered prophase which was not creditworthy.

Question 8(b)(ii)

Candidates were asked to describe the process of crossing over.

Most candidates were able to describe the formation of chiasmata and the exchange of sections of chromatids.

However, fewer candidates understood the difference between sister chromatids and non-sister chromatids.

Question 8(c)

Candidates were asked the meaning of a correlation coefficient value of 0.77. Candidates who analysed the graph were able to select the correct answer even if they didn't understand correlation coefficient calculations.

Question 8(d)(i)

Candidates were given a graph showing the results of an investigation into the starch content of diets and the number of copies of the amylase gene.

Candidates were asked to state the mode for the number of copies of the gene in individuals with a high starch diet. It was clear that many candidates did not understand how to determine the mode of a set of data.

It is important that candidates are taught all the math skills listed in the specification.

Question 8(d)(ii)

Candidates were asked to discuss the statement that the number of copies of the amylase gene AMY1 could be an adaptation of an organism to its diet.

This was the only level-based question on the paper, and a range of length and depth of answers were seen.

Candidates were given a specific instruction to give reasons to support their answer that used information from all parts of question 8 and their own knowledge. It is important that candidates are taught to take careful note of these types of instructions, or they're going to limit the level that they can be awarded in their answer.

Candidates typically achieved level 1 by describing the provided data or giving basic information with limited linkage.

Candidates typically achieved level 2 by using knowledge from other parts of question 8 to support their answer, for example relating the functions of amylase and maltase to the information given in the graphs. Some application of relevant knowledge was also seen, for example regarding uses of glucose in respiration and the uses of the ATP produced.

Candidates typically achieved level 3 by extending their answer further to include not only additional relevant biological knowledge but also a discussion as to why it may not be an adaptation of the organism to its diet.

A number of candidates incorrectly interpreted a bar chart, of the number of AMY-1 copies in people with high and low starch diets, stating that those with low starch diets had more copies of the gene.

Another common misconception in weaker responses was that the mutation was caused by higher starch diet.

Paper summary

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

- 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.
- Understand the difference between a 'describe' and an 'explain' response.
- Information provided in the introduction to questions is provided for a specific reason. Read it carefully and analyse what information will be needed to provide a high-level response to the question being asked. If you have been provided with diagrams analyse them carefully too.
- Do not try and make a mark scheme you have learnt from a previous paper fit a different question with different context and command word.

- Study all of the mathematical skills in the specification which could be tested at this level.
- Do not give your answers as fractions unless you are asked to.
- 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.
- Take careful note of instructions regarding the presentation of your calculated answer, e.g. give your answer to the correct number of significant figures.