Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

Summer 2019

Pearson Edexcel Advanced Subsidiary In Biology (8BI0) Paper 01 Core Cellular Biology and Microbiology

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Introduction

Between the students sitting this paper, almost every mark on the paper was achieved and almost all questions achieved the full range of the marks available. Questions that demanded recall tended to score well, e.g. when describing what is meant by the tertiary structure of a protein. Whereas analysis and explanation questions often achieved low marks with many students just describing rather than analysing the data provided, or explaining the points made.

Many students did well with the questions testing their understanding and ability to apply mathematical skills. Unfortunately, there are still a significant number of students who struggled with the calculation questions, particularly those that required some application of biological knowledge and understanding as well. Many students struggled with questions relating to practical work and techniques.

Successful students:

- answered questions in the context set;
- were able to analyse rather than just describe the data provided;
- provided specific, relevant details to their answers;
- applied their knowledge of practical techniques and processes and were able to explain rather than just describe practical steps;
- demonstrated the ability to convert units and make sense of applied mathematical questions.

Question 1

Q1(a)(i) Most students correctly identified translation from the diagram.

Q1(a)(v) Most students correctly identified the amino acid on the diagram.

Q1(b) This question achieved the full range of marks. Many students just calculated the percentage of bases in the DNA strand ignoring (or missing) that the question asked them to calculate the percentage of bases in the mRNA synthesised. Some students correctly recognised that there is no Thymine in mRNA. Some candidates ignored the number of bases in the DNA and tried to work out the percentage of bases from the 23.3% of Adenine in the mRNA thinking that this was a double stranded molecule with base pairing between the mRNA bases. i.e. 23.3% Thymine and then (100 -46.6)/2 for both the Cytosine and Guanine.

Question 2

Q2(a)(ii) Many students correctly recognised that the enzyme is involved in forming phosphodiester bonds between the phosphate and the sugar on nucleotides. Some students included the need to join Okazaki fragments or described the need for working in the 3’ to 5’ direction. Some students incorrectly implied that it was involved in the joining of the complementary base pairs to form the double helix

while others described a role in the formation of mRNA in translation, despite the question clearly stating DNA replication.

Q2(b) Many students recognised that two new cells would be formed (although some just mentioned two new nuclei rather than cells), with many correctly describing or naming cytokinesis. Some students correctly described what happened to the quantity of DNA in the cell as the result of cytokinesis. However, some students did not gain the mark by just describing the DNA content as being reduced, particularly as they could refer to the values given on the graph.
Some students described the whole of mitosis as happening in the stage, often without cytokinesis.

Question 3

Q3(a)(ii) Many students recognised that the tertiary structure was the 3D folding of the protein held together by named bonds. Some students recognised that these bonds were between the R groups of amino acids. However, some students named peptide bonds as being involved in the folding of the protein so were not given credit for the bonding.

Q3(b) Many students correctly recognised that the initial rate would be lower so drew a line below the existing line. Some recognised that this could be very significant to the activity of the enzymes, so their lines were just above the x-axis. However, many candidates thought that the rate of reaction would increase or would achieve the same rate of reaction as the RNase without mercaptoethanol, perhaps assuming this was an example of competitive inhibition. A few students did not attempt to sketch a line on the graph.

Q3(c) The most common marks gained were for recognising that the active site would have changed shape (or been denatured) and that the RNase would therefore no longer be able to catalyse the reaction. A few students recognised that this would be because the mercaptoethanol would change the tertiary structure of the enzyme and a few commented on the effect on the initial rate of reaction. However, several students described competitive inhibition and others thought that the mercaptoethanol was an additional substrate or an additional enzyme, so the rate of reaction would increase. Some students described how because some of the bonds were already broken that the rate of reaction would be quicker, not linking the broken bonds as belonging to the enzyme.

Question 4

Q4(a)(i) Many students correctly identified that this would have to be meiosis and went on to describe the need for reduction division or produce haploid gametes. However, many students thought it would be mitosis because the female bees were diploid, and they produced diploid females. Some students named and described oogenesis in mammals ignoring the context of the question.

Q4(a)(ii) Many students correctly identified that this would have to be mitosis and recognised that the male bees were already haploid so further reduction division would not be needed. However, many students thought it would be meiosis because only meiosis can produce haploid cells. Some students named and described spermatogenesis in mammals ignoring the context of the question.

Q4(b)(ii) A lot of students correctly identified acetic orcein as a suitable stain, with toluidine blue and acetocarmine also appearing as correct answers. The most common incorrect stain suggested was iodine and there were several blank responses to this question.

Q4(b)(iii) Few students explained the points they made despite this being an explain question. The most common correct answer was for some idea of squashing or teasing the sample to spread the cells. A few students gained credit for referring to heating to intensify the stain. Many students described how to apply a coverslip and then how to use a microscope, but rarely with an explanation of why a coverslip was needed, etc. A significant number of students appeared to struggle to recall any details of this practical technique.

Question 5

Q5(a) The majority of students were able to identify a feature of the cell that would not be found in a prokaryote such as the mitochondria, nucleus or membrane bound organelles. Others correctly identified features of a prokaryote that would not be found in the cell in the diagram such as a cell wall, nucleoid or plasmid.

Q5(b)(i) The majority of students included arrows that showed movement from the RER to the Golgi and from the Golgi to vesicles and out of the cell. Some students had arrows straight from the nucleus to the Golgi, with others not showing movement to the surface or out of the cell. Others drew a cycle or just arrows showing the amino acids moving into the cell (or nucleus). A few just followed the order of the headings and drew arrows from the Golgi to the RER and then the vesicles, ignoring the values in the table. There were a few blanks to this question as well, possibly because they ignored it because there was not an answer line to write on.

Q5(b)(ii) The responses of many students were very vague or very general, often just describing or repeating the data (frequently in the order it is displayed in the table i.e. Golgi first) rather than interpreting it. Descriptions of the route taken were common but with no reasoning or detail of what happens at each stage (ignoring the context of protein synthesis), or the opposite – explanations of what each structure does but with no reference to the data provided and therefore the route taken. Students should note the command word **comment** "*requires the synthesis of a number of variables from*

data/information ***to form a judgement."*** - not just a description or turning data from a table into prose.

Q5(c)(i) Many students recognised that there would be more undigested food and/or fewer enzymes in the small intestine as a result of the pancreatitis. However, some students seemed to think that food goes into the pancreas to be digested, or that enzymes travel to the stomach from the small intestine.

Q5(c)(ii) Many students gained a mark for recognising that this could cause some form of damage to the pancreas. Few students went on to describe a possible consequence of this damage to the pancreas. Many students thought that the active enzymes could reduce the symptoms of the pancreatitis, e.g. by unblocking the duct. Some students described substrates as having an active site that the enzyme fits into.

Question 6

Q6(b)(i) The majority of students were able to identify the correct figures to use from the table and calculate the percentage change, with many recognising it was a decrease and including the – sign. However, many students divided the change by the wrong value and others did not attempt to calculate a percentage change.

Q6(b)(ii) Many students correctly deduced that the oocytes were produced before birth and there were a wide range of ways in which students expressed this. The most common incorrect answers were:

- "at birth"
- "during adolescence"
- "11-17"
- "18-24"

Q6(c)(i) The majority of students correctly identified a structural difference between a spermatid and a mature spermatozoan with the lack of a flagellum/tail being the most common answer. The most common incorrect answer was that spermatids were diploid.

Q6(c)(ii) Most students were able to identify that the spermatid was unable to fertilise the egg, most commonly because they could not swim, although many described the importance of the acrosome reaction well. Some students discussed competition and cooperation between sperm which was not relevant to this question.

Q6(c)(iii) Marks were most commonly awarded for some idea of the "best" sperm fertilising the egg, with few students going on to refer to the inheritance of advantageous alleles or natural selection. A lot of students described the need for many sperm/acrosome reactions being needed to penetrate the zona pellucida.

The most common incorrect answers referred to many sperm being needed for increased genetic variation.

Q6(c)(iv) The most common correct answer referred to the idea of selection and designer babies. Many students made some not very clear reference to abnormality, with clearer responses correctly identifying that a gene mutation (that caused the disorder) could be inherited because of the technique. Common answers that were not given credit were the usual references to religious or cultural arguments and others referred to the cost of treatment and stress to parents.

Question 7

Q7(a)(i) Surprisingly few students realised that citric acid would lower the pH and therefore could denature the enzyme. Many stated that citric acid would increase the pH, others that it would "kill" the enzyme. Some students thought that the citric acid was a competitive inhibitor or the substrate.

Q7(a)(ii) Students did recognise that this would work because the enzyme would be digested because it is a protein. Some suggested that the protease might digest the phenols or melanin. Although this is not correct, they were given credit as there was no indication in the question whether phenols or melanin were proteins. However, many students incorrectly described competitive inhibition or thought that the protease would be a substrate.

Q7(b)(i) Most students gained some credit for describing the positive correlation, but often just restated the data from the table in prose with no analysis or explanation of the data provided. Some students did recognise that the increase in melanin concentration was non-linear and a few correctly identified that this would be because the substrate became limiting.
Some students misread the table and context and described how melanin increased as the number of slices of apple increased.

Q7(b)(ii) The majority of students did not achieve anything beyond a level 1 response where they had identified some of the key variables. Level 2 responses typically gave a suitable range of temperatures for the independent variable and described how they would control the temperature with a water bath. Few students gave suitable descriptions for how they could attempt to measure the melanin concentration. The use of a colorimeter was the most common suitable method described (although some wanted to use a calorimeter). Some students did describe how to control other variables, e.g. pH using a buffer solution but, given the context of the practical, it was disappointing that this was not more common. Despite the information given on the table, many students decided to leave the apples for 20 or 30 minutes, or longer. There was no attempt made to explain what effect a variable could have on the results, or to set up a suitable

control, e.g. to check whether temperature has any effect on the melanin produced.
Some students gave no clear thought to the sequence of steps in their methods, e.g. cutting and crushing the apple slices before putting them in the water bath. Others thought that they had to add polyphenol oxidase to the apples and describes a thermometer as controlling rather than measuring the temperature.

Question 8

Q8(a)(i) There were a significant number of very good responses that clearly compared the folding and structures of the proteins and explained the differences in solubility between fibrous and globular proteins. Some students provided little clear detail, and some did not make clearly comparative answers, e.g. just describing a fibrous protein.

Q8(a)(ii) Many students successfully converted μm to nm (or vice versa) and calculated how many times larger the microtubule was than the single tubulin molecule. Some students converted the units but failed to complete the calculation. Others thought that μm were smaller than nm or ignored the units completely.
There were some very good responses that used standard form in their working to achieve the correct answer.

Q8(b)(i) Many students were able to describe a correlation between length and the concentration of tubulin and the idea that centrioles are needed. Few explained why the higher concentration increased rate of microtubule formation. Some students described the concentration of centrioles increasing, or that more microtubules were produced rather than the length increasing. A few recognised that rate of increase is non-linear, but very few linked this to a limiting factor.

Q8(b)(ii) A significant number of students did not attempt this question. Most attempts discussed either pH or temperature (more frequently) but not both. Some, however, described the buffer controlling the temperature. Few students clearly described equilibration.
Some students gained marks for linking changes in pH or temperature to denaturing, but few discussed which bonds could be changed/disrupted that would cause the denaturing.

Q8(c) A significant number of students did not attempt this question. The most common marks were awarded for suggesting that the microtubules may break, or a suitable comparison being made to the process in nuclear division (these were not always correct.) More common were references to tubulin being a limiting factor and being used up, but this does not explain the decrease in length. Some students tried to link to the previous question by referring to the need for centrioles and that they might either disappear or denature.

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. In particular, make sure you are answering the question asked, especially when there is not an answer line to write on;
- use all of the information provided in the question to help you with your answer, e.g. graphs and tables of data including the labelling;
- when asked to explain your answer make sure you have effectively included 'because...' in your response;
- when asked to describe ethical implications make sure your answer is specific to the context of the questions and don't just state a general concern such as religious, cultural or cost issues without any context;
- aim to evaluate practical procedures and identify why stages are needed in procedures during your practical work in the AS course;
- set out calculations carefully showing each stage of your working in case a mistake is made at the final step and check that the magnitude of the answer makes sense in the context of the question;
- be specific in your vocabulary avoiding vague terms such as amount and use something measurable such as volume or mass;
- look at the appendix 6 and 7 of the specification to familiarise yourself with the command words and the examples of the mathematical calculations you are expected to be able to perform at AS level.

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