



## **General Certificate of Education**

# **Biology 5411**

## *Specification A*

### **BYA2      Making Use of Biology**

# **Report on the Examination**

## *2007 examination - January series*

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## General

Better candidates scored very high marks on this paper, and all questions proved to be accessible. The examiners were pleased to see many candidates scoring more than 60 marks, and even a significant number scoring marks in excess of 70. The standard of written expression seemed particularly poor this time. In the longer questions, or when asked to suggest an explanation, too many candidates gave 'woolly' answers with generalisations that did not stand up to scientific scrutiny. In addition, many confused processes, such as PCR or genetic engineering instead of protein synthesis, and eutrophication instead of pesticide pollution. Once again, candidates' mathematical skills were poor, especially in 5 (b) (i).

### Question 1

- (a) (i) The labelling of the diagram was usually correct although some candidates failed to respond to this question.
- (ii) Most knew the components, especially phosphate. While many correctly identified the sugar as pentose or a 5C sugar, a substantial minority simply gave the term 'sugar'. A significant number failed to take into account that it was DNA, and suggested ribose.
- (iii) The majority of candidates knew that hydrogen bonds were found at Y, though a few thought they were covalent, disulphide, glycosidic or peptide bonds.
- (b) (i) Hardly any gained full credit here. Very few candidates included reference to the number of bases required to code for an amino acid. Of those that realised this, many failed to score the second marking point. A significant number employed poor expression in their response, suggesting that three bases **made** an amino acid, rather than coded for an amino acid. There were many references to codons in responses. A significant number included irrelevant detail about mRNA, tRNA and translation.
- (ii) This was poorly answered by the vast majority. Many candidates responded by suggesting that double strands allowed a large quantity of information to be stored, arguing that DNA was a compact molecule. Few gave a correct response, usually about the stability of the molecule.

### Question 2

- (a) Many candidates were able to give a correct definition although some considered an antigen to be an organism or a protein on a molecule. There was much loose expression referring to substances.
- (b) This was also answered well by many, although there were still some who failed to put a cross as instructed, leaving only ticks and blank spaces, or entered an ambiguous symbol. A significant number believed that AB would not result in agglutination, and believed incorrectly that Anti-B would result in agglutination with sample of A.
- (c) The concept of genetic fingerprints being unique or specific to individuals was well understood. Many candidates discussed the opportunity of comparing the fingerprint of the child with that of the potential father, and identified similarities. A significant number, however, failed to discuss blood groups when making their response and related their answer solely to genetic fingerprints. When blood grouping was discussed, many indicated that father and child could have different blood groups. There was evidence of

confusion regarding the number of possible different blood groups. Although large numbers realised that groups would be shared by many people, the weaker candidates only expressed this as 'blood groups are common' offering no further explanation or qualification.

### Question 3

- (a) (i) The majority of responses fell within the accepted limits. An answer of 55 was sometimes seen, but the commonest incorrect response was 120.
- (ii) Most candidates also gained full credit for this section. Large numbers realised that chromatids separated at anaphase, but significant numbers failed to indicate that movement would be towards the poles of the nucleus or cell. Some of the descriptions of the distance between chromatids increasing were rather imprecise with references to the gradient increasing, the graph going up or the distance changing.
- (b) The cell cycle seems to be quite well understood and there were many good responses which related to events occurring in the cell. A surprising number who understood this failed to state the obvious by indicating that the chromatids would not be visible in this time period. Some thought the chromosomes were too small to see at this stage rather than being too diffuse.
- (c) (i) Surprisingly few gave zygote as the answer – responses included embryo, gamete, fertilized egg cell, blastocyst and fetus.
- (ii) Many were more concerned with the role of meiosis in producing variation rather than in maintaining the correct number of chromosomes in each generation.

### Question 4

- (a) Many correct responses were seen, and, where errors occurred, they usually concerned the action of the ligase, often linked with base pairing. Mis-spellings included lipase and lignase. Some candidates suggested that polymerase and helicase were involved; they may have been but either before or after the event in the diagram.
- (b) (i) Most understood that the gene for resistance to antibiotic X was still intact and, therefore, functional.
- (ii) Most candidates understood that the gene for resistance to antibiotic Y had been disrupted. Where error occurred it was usually as a result of failing to refer to the resistance gene in the response. Many wrote that the insertion of the new gene disrupted or damaged the antibiotic Y not the gene for antibiotic Y resistance. The other major error was to state that the gene for resistance to antibiotic Y had been removed or cut out, either totally or partially by the insertion of the new gene. Clearly such candidates failed to appreciate that the whole gene for resistance to antibiotic Y was still present, but had new sequences added to it. Some tried to explain the role of a marker gene as determining whether or not a bacterium had taken up a modified plasmid.

**Question 5**

- (a) Many candidates revealed a good grasp of the concept of a control and gained both marks. Some failed to make their answers clear enough and were penalised by the poor quality of their written communication. Weaker candidates thought that fertiliser should also be used on the control crops, or that variables should be kept constant rather than the same as for the experimental group.
- (b) (i) Relatively few correct calculations were found. The commonest error was failing to work out the actual increase, simply dividing the first reading by the second. Even those who calculated the difference correctly often then divided by 3224 instead of 258. Others failed to multiply by 100. There were even instances of candidates who carried out a correct calculation, then crossed it out and replaced it with an incorrect solution.
- (ii) Candidates rarely gained two marks here. Answers concentrated on maize 'needing more NPK than wheat' or variations on this. Very few candidates seemed aware that wheat may require different nutrients and most gave inability to take up the minerals or other limiting factors as being responsible for the reduced yield.
- (c) A lot of correct responses were seen although some stopped short and simply referred to the fertiliser no longer being limiting. The concept of limiting factors was well understood by a large number, although many incorrectly used this argument for the previous question and failed to repeat themselves in this section. A significant number used an argument based on the 'Law of Diminishing Returns'. Other arguments involved the toxic effects of increased concentration and consequent root damage leading to less absorption.
- (d) Many good examples of secure knowledge and understanding were seen. Most gained both marks, although there was still much emphasis on cost.

**Question 6**

- (a) This was one of the areas that gave rise to vague and non-scientific answers. Some showed lack of thought such as that 'fish eat bacteria which have taken up the pesticide'. Eutrophication is still the answer to every pollution question for some candidates. Many thought the fish gained more pesticide the more they ate but then failed to apply this to concentrating it through the food chain. Few answers included reference to the fact that the pesticide was not biodegradable or mentioned that it is stored in tissues. A significant number of weak candidates incorrectly believed that the pesticide was gained by the fish "breathing in water".
- (b) Many failed to gain credit as their answers were too vague. The most successful candidates were those who established the link with plants. Otherwise answers simply made vague reference to suggesting that pike ate fish, without any consideration of the relative position in the food chain. Large numbers just said that pike would contain more pesticide than perch without explaining why.
- (c) A lot of candidates gained both marks but, again, some just said the smaller pike would contain less pesticide without giving an explanation. Weaker candidates suggested that

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small pike had smaller surface area to volume ratios and, therefore, lower concentrations of pesticides.

- (d) This section was not answered well, and few candidates gained full marks. Although the principle that less pesticide would be employed was understood by a many, only a small number appreciated that the integrated approach combined the advantages of both methods. It was apparent that candidates were aware that the individual methods each had their own advantages, but all too often responses lacked the required precision. Accounts based on imprecise use of pronouns, 'it' kills the pests quickly or 'it' eradicates the pest completely or 'it' only needs to be applied once were frequent. Many concentrated on the disadvantages of each separate method rather than the positive points - this would have worked if they had then drawn the positive parallel for the alternative treatment. 'Immunity' rather than 'resistance' to chemicals was used by many candidates.

### Question 7

- (a) A lot of good answers were seen. Candidates failed to gain marks mainly through failing to refer to the active site, or not mentioning the idea of fitting or binding with complementary substrates. Only one or two wrote about the substrate's active site.
- (b) In their responses to this part of the question, some failed to mention resistance to high temperatures, while others gave general features of enzymes, such as that 'they are not used up in the reaction'.
- (c) (i) Most seemed to understand this concept quite clearly although some failed to gain the mark by suggesting that the enzymes are produced outside the cell.
- (ii) Almost all candidates were aware that intracellular enzymes required more complex purification procedures, though some did not refer to breaking open the cells. Poor expression was once again apparent. It was sometimes difficult to differentiate between the need to break open the cell or break open the enzyme. A few thought it would mean no downstream processing would have to take place.
- (d) Most candidates were able to answer satisfactorily. Some thought that the difficulty of obtaining the bacteria in the first place was the costliest part even though the question asked about culturing the bacteria. Some implied that the enzymes, rather than the bacteria, were cultured.
- (e) Only a few really good responses were seen. Some mentioned reverse transcriptase but obviously didn't understand its role. Others concentrated on making the protein from the mRNA rather than obtaining the gene.
- (f) Some excellent responses were seen although some missed the point entirely and discussed the formation of modified plasmids or the PCR. When error occurred it was often through lack of detail. Nucleotides, for example, were not always identified as **RNA** nucleotides. tRNA was stated to collect amino acids rather than **specific** amino acids. Frequently DNA polymerase was considered to be involved. A significant number of candidates implied ready-formed mRNA pairing up with the DNA. Only the better candidates discussed the removal of introns when the mRNA was synthesised. A significant minority omitted any discussion about transcription and began their response with attachment of mRNA to the ribosome. Drawings were included in some

responses but without sufficient annotation or labelling to make them very useful. Some incorrect names were provided for the bonds between the amino acids. A significant number had little knowledge and this question was left blank. Although not many reached the maximum mark allowed for transcription, they often gained full credit for their accounts of translation.

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**Question 8**

- (a) Some excellent answers gained full credit. Very few mentioned that hormones are transported in the blood. Some thought FSH produced follicles or failed to realise that oestrogen is produced by the follicle rather than by the oocyte or the ovary. Others believe it is the follicle that is released at ovulation. Regular omissions in arguments related to a failure to state that FSH/LH was secreted when oestrogen concentrations were **high**. Almost all went on to describe events after ovulation and brought in accounts of the role of progesterone. A significant number did not attempt this part of the question.
- (b) Not many candidates gained both marks. There were numerous statements about the hormone needing to be in the blood but then failing to explain why it would not enter the blood if taken orally. Those that said it would be digested then didn't say it would be broken down into amino acids. Others picked up both marks by describing the acidity in the stomach denaturing the protein. A few weak candidates described the protein as being absorbed from the digestive system, but considered that it would just take too long.
- (c) (i) Two marks were achieved by the many candidates who kept to the point.
- (ii) A large number scored both marks, but once again some candidates related their answers to the incorrect hormone or process. They had an understanding of clomiphene interfering in the negative feedback process, but unfortunately related their answer to LH or ovulation.
- (d) Although only the better candidates gained full credit, many scored two marks. Some clearly did not know which calculations to do, and even if they made an attempt they did not explain what the figures represented. However, a lot of candidates were able to calculate the percentage success rate in order to support their choice. Only one or two worked out the cost per pregnancy in order to see which was more cost effective.

**Mark Ranges and Award of Grades**

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