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Examiners' Report

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In Human Biology (4HB1) Paper 02R

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## Introduction

This paper was sat by students following the dissemination of the Advanced Information to centres which detailed the topics covered in the examination.

There were several questions contained in this paper that were presented in contexts that had not arisen in previous examination series and candidates struggled with this. This proved to be a challenge for many where a fair number of students were unable to apply their underlying knowledge of topics in the context given despite showing a good understanding of this content in previous examinations. It was also evident that candidates were unfamiliar with some of the practical topics that were tested in this paper and most responses to these questions failed to gain full marks. Similarly, there were several topics where student answers were vague or lacked clarity in their structure making it difficult to award in many instances full marks. Several questions, however, encouraged some excellent responses where good use of scientific terminology was seen, some of which was beyond the expectation of a Level 2 award.

- 1a There were a variety of different diagrams showing how the apparatus should be set up to investigate whether there was more carbon dioxide in exhaled air compared to inhaled. Of those that were incorrect students often omitted to include the indicator in the conical flasks which cost them two marks. It was quite evident that several students were unfamiliar with this investigation as diagrams clearly showed that the set-up would just not work. In nearly all drawings the rubber tubing was omitted suggesting that candidates were unaware of how this piece of apparatus was used in constructing the overall set-up although students were not penalised for this.
- 1b Most candidates were able to identify the correct indicator to test for carbon dioxide and correct answers were divided between limewater and sodium hydrogen carbonate. Incorrect answers included water, hydrogen peroxide and spirometer where it was clear that students had not had access to this practical activity.
- 1c Marks were awarded to students who were familiar with this investigation, including information that strongly suggested inhaling and exhaling through the mouthpiece (often termed 'T-piece'). In responses seen, there was no mention of the number of times or the length of time that inhaling and exhaling needed to be carried out for and, similarly, few candidates discussed comparing results i.e. the change in each conical flask. Students were awarded marks regardless of which indicator they included in their details and responses such as 'colour change' for sodium hydrogencarbonate or 'cloudy/milky' appearance for limewater were awarded if they were in the correct context.

- 1d Some candidates were vague in their responses stating that the mouthpiece should be cleaned rather than sterilised. Others included information such as don't share the mouthpiece and responses often stated that the long tube should not touch the indicator. Further answers mentioned that gloves or goggles should be worn or 'do not drink the limewater' which came up quite often was too vague as was 'sterilise the tube' rather than the mouthpiece. These were not credited. A fair number of candidates, however, were able to provide correct details on a safety precaution and the most common correct answer was to sterilise the mouthpiece.
- 1e Although several candidates stated that the volume of inhaled and exhaled air should be controlled (which was not credited) most were able to arrive at the correct answer by recognising that the volume of indicator or limewater/sodium hydrogencarbonate was the control variable in this investigation. There were a few other incorrect answers such as temperature or volume of water that did not gain a mark and many candidates used the term 'amount' rather than volume of indicator which they should be refrained from using. Although a mark was awarded in this case it should be noted that 'amount' is not the preferred term.
- 2ai A vast number of students described control variables rather than give details of a control. Examples such as keep the temperature or volumes of solutions, usually named, the same. It appears that candidates are challenged in distinguishing between a control and control variables. Those that did attempt to describe a control usually always included adding the enzyme to either the indicator or the inhibitor and it was rare to see even 1 mark in responses for this question.
- 2aii There were many responses that stated 'volumes' (rather than concentrations) of the various solutions used in the investigation (volumes of enzyme/inhibitor and alkali solutions) should be kept the same despite the method given in the stem giving the actual volumes used. These were not credited. Most commonly, marks were awarded for candidates that identified temperature and pH as control variables.
- 2bi Most candidates used the information from the table well to gain the full three marks for plotting the results of the investigation. There were few instances where the axes labels were the wrong way round or not labelled at all and occasions where candidates failed to add units to the labels.
- 2bii Curves of best fit were drawn well in most cases. Marks for joining the plotted points together, with or without a ruler, were not awarded.
- 2biii Of all the items forming question 2b, this proved the most challenging for students. This implied that students were unfamiliar with graphical representation of enzyme inhibition. There were several curves that were drawn underneath the graph line drawn from question 2bi.

- 2c Candidates mostly got the idea that the intensity of the pink colour would be lower due to the presence of the non-competitive inhibitor but the majority of these failed to give clear details to award a second marking point. Many responses indicated a lack of understanding of why non-competitive inhibition is not affected by changes in substrate concentration.
- 3ai A well answered question with the vast majority of candidates drawing a clear arrow showing the correct direction of blood flow through the vein. Incorrect answers obviously included an arrow in the wrong direction but also arrows placed randomly within the walls of the vein as well as arrows pointing in both directions.
- 3aii There were several candidates that did not identify vessels A and B which restricted the marks that they obtained for their responses to a maximum of two. Marks were also lost for students that failed to state that valves prevent backflow of blood. Many responses covered the same marking point more than once. For example, for an artery, candidates included most details for marking point 1 although infrequently gave any information about vessel A pumping blood away from the heart or carrying blood at high pressure. There were a fair few students that showed some confusion in naming the vessels, stating that A was a vein and B was an artery.
- 3bi This was generally a well answered question with responses indicating that students were able to analyse the graph well to draw valid and correct conclusions for 3 marks. Candidates that were unable to obtain full marks most often gained 2 for identifying a decrease in deaths and that more deaths occurred in males.
- 3bii There were mixed responses to this question. Candidates that did not manage to gain full marks often failed to correctly convert 60 million into figures. Values such as 6 000 000 were seen frequently meaning that few students failed to gain full marks for their final answer.
- 4a Candidates often came up with at least 2 marks for identifying methods of birth control although some generally lost a mark for just stating contraception or for repeating the same marking point. For example, one commonly named method for one mark was condoms although a further answer given would often be another barrier method that could not be awarded. One incorrect method seen frequently in responses was refraining from sexual intercourse or withdrawal.
- 4bi There were a fair number of responses that gave a final answer of 72 mm which did not gain a mark despite most showing clear working out. In these cases, candidates appeared to use the line representing the oestrogen concentration rather than the one representing the width of the endometrium. There were other responses that used incorrect readings from the correct line on the graph which were not awarded.

- 4bii Candidate responses were mostly clear and detailed for this question with a good number achieving full marks for the information given. Where marks were lost, this was generally for failing to omit clear details linked to fertilisation (marking point 2) although most students were able to gain at least two marks for recognising that the uterus lining increased in thickness and that this was needed for implantation to occur.
- 4biv Many marks were lost here where students lost sight of the question and failed to discuss how the *lines* would change. Most responses focused on providing details about how the thickness of the lining would change and the effect on the uterus lining of an increase or decrease in the levels of hormones. Candidates that were able to score one mark most often gained this for stating that the uterus lining remained thick (marking point 1).
- 5a A well answered question where the vast majority of candidates understood that a disaccharide comprised of two monosaccharides, sometimes correctly named monosaccharides, were joined together. Responses that did not gain the full marks often failed to mention that the monosaccharides were joined or linked, and others used the term 'saccharide' rather than 'monosaccharide' which involved an element of doubt. There were many responses that gave more detail than expected at this level. For example, students included information about glycosidic bonds which, although not incorrect, did not gain them any marks. Some answers included details of condensation reactions without clarifying that this type of reaction involved the *joining* of monosaccharides. Other responses seen described disaccharides as 'made up from monosaccharides such as glucose' without clearly stating that it was just two monosaccharides. Again, these were not given any credit.
- 5b Many candidates obtained a mark here for understanding that lactose or the disaccharide was too large to be absorbed into the blood. Candidates that did not score, and there were a good number, often stated that the lactase had not been digested or that the enzyme lactase was not present.
- 5ci There were only a few candidates that mentioned transcription would not occur and that mRNA would not be produced. Some made reference to the gene being non-functional but, most commonly, one mark was gained by students who included information linked to lactase or a protein not being produced.
- 5cii Candidates scored at least one mark here and responses showed a reasonable understanding, in several cases, of the effects on a person if the gene for lactase production was switched off. There were many two mark responses although it seemed that a fair number of candidates failed to interpret the question correctly and gave details of health effects such as tiredness or lack of energy which were not credited.

- 5d Many responses included details about the lactase gene being switched off and intolerance to lactose. Other answers did not gain credit for discussing how the allele was passed to the next generation, providing details of how evolution is brought about rather than being clear that lactose tolerance gave individuals an advantage over others. Some candidates were able to score one mark for stating that lactose tolerant individuals drank more milk or ate more food containing lactose.
- 5e Candidates that attempted to answer this question tended to score some marks and it was encouraging to see the use of some good scientific terminology in responses. For example, use of the term water potential was presented in much more scientifically structured sentences. There was some misinterpretation of the question where a few answers elaborated on the deficiency of calcium in the diet causing the symptoms of lactose intolerance.
- 6ai Responses made it quite clear that candidates were familiar with the importance of blood clotting and there were many well-structured, correct answers that included preventing blood loss and the entry of pathogens. Most answers gained full marks. Candidates that did not obtain 2 marks often gave more vague detail such as 'to avoid microorganisms' or 'to heal a wound' or used the term 'germs' rather than pathogens or microorganisms that was not acceptable. Preventing infection was also insufficient to gain the second marking point.
- 6bi A fair number of candidates failed to attempt this question. There were very few responses that identified the faulty allele being carried on the X chromosome so not many candidates obtained marking point 1. Probably by default candidates gave the genotype of the male ( $X^hY$ ) and/or the female ( $X^HX^h$ ) which gained credit for either or both of the first two marking points and some, although few, identified the allele for haemophilia being recessive. However, most students worked hard on their response to this question and many were able to gain at least 3 out of the 5 marks available.
- 6bii Many candidates were able to deduce that the probability of the child being a male would be 50% although less students gained a mark for the probability of inheriting haemophilia (marking point 4). It was quite often seen that answers for this marking point also gave 50% which had a knock-on effect to the next marking point where, in calculations, students working led them to an incorrect final answer where candidates were expected to calculate the probability of a child being a male haemophiliac. There were several responses that correctly stated the genotypes for the male and female and where these were seen in answers candidates usually scored at least 3 marks.

- 7b The most common correct answer was in responses that mentioned blood entering the kidney contained more urea than that leaving although this was, unfortunately for many, the only marking point achieved. Candidates more often tended to compare the volume of water, mineral ions and glucose entering and leaving which were not credited.
- 7ci There was a definite uncertainty amongst candidates on how to calculate a percentage different. In responses that did not obtain full marks, a vast range of values was seen in workings that were not laid out clearly and confusing. More often, however, the actual calculations given were incorrect, where values were multiplied, added or subtracted rather than divided for example. One mark was frequently awarded for candidates using the values for total nitrogen compounds from the table in a subtraction calculation.
- 7cii Candidates generally gave good responses for this question and gained full marks. They were easily able to identify urea as the main nitrogen-containing excretory product in urine with some using the information in the table to explain their answer for marking point 2.
- 7ciii This was a challenging question for most students who were unable to make a connection between creatinine and muscle metabolism or breakdown. Responses were unlikely to achieve anything more than a reference to creatinine and further elaboration, such as comparison of the amount of this compound in the two diets, was rarely seen.



## Summary

Several points can be raised from the responses seen in this paper.

The practical elements of the specification will be tested in the examination papers, and it is important that candidates are aware of this. If candidates do not have access to laboratories with adequate equipment, then they should at least have a theoretical understanding of practical methods that they can apply to examination questions. This includes knowledge of variables (as well as the difference between a control and a control variable), risks and safety procedures and an idea of how practical procedures can be improved.

There is always likely to be some form of graphical analysis and/or plotting of graphs and charts in examinations. Some candidates lost marks for incorrectly placing the axes labels or missed important detail when labelling the axes. Students might be reminded that the axes labels should be identical to the information given in column headings shown in any tables given and that the independent variable is always presented on the X axis.

There was some misinterpretation of a few questions in this examination. This may be related to a lack of identification of command words, particularly those used less frequently. Candidates often cannot distinguish between describe and explain, for example, and this was evident in some cases in this paper. It is important that candidates are exposed to as many of the command words as possible during the course of their learning in order to ensure that the expectations of each are fully understood.

