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Principal Examiner Feedback

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In Human Biology (4HB1)
Paper 02

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Question 1

- (a) There was a large variation in responses to this question with many candidates either correctly completing the type of organism causing the disease or the method of transmission. It was not often that 6 marks were seen in the answers given. Most often, for the type of organism candidates tended to lose marks for guessing which, although admirable for effort, failed to gain marks in many cases. Students were aware, however, of the different organisms that cause disease. A similar circumstance was found with method of transition where students made an attempt at answering although answers sometimes lacked the clarity and detail needed to gain a mark. In several responses 'animal vector' was seen which was dubious but given benefit of the doubt although responses that included sneezing or coughing for polio and typhoid were ignored.
- (b) The majority of candidates were aware that athlete's foot was a fungal infection and that antibiotics were only effective against bacterial infections. There were few responses that deviated from this and these varied in their detail ranging from athletes' foot being caused by a virus to fungi being resistant to antibiotics. These responses were not awarded.

Question 2

- (b) There were a vast number of responses that stated tube C was used as a control which was incorrect as this could also easily have been the case with tube A. Very few candidates included details that referred to the bile salts and that tube C was set up to elucidate the effect of bile salts on fat digestion. Many candidates scored one mark for providing details that implied tube C was set up to investigate the effect of the enzyme on the breakdown of lipids. Responses to this question were mostly scant where more depth of thought and more careful analysis of data was needed by most to score more than one mark.
- (c) Most candidates were able to score at least one mark here for recognising that the addition of sodium hydrogencarbonate was to adjust the pH, to increase it to provide alkaline conditions. There were numerous responses that stated the sodium hydrogencarbonate was added to neutralise the solution – these were given the benefit of the doubt. It was less often that marking point 2 was covered in the details given by students. Although they were mostly aware of the role of sodium hydrogencarbonate, candidates were less inclined to provide any further information on how the pH of the solution affected enzyme activity. This inevitably restricted many responses to one mark only. There were a few answers that linked the addition of sodium hydrogencarbonate to increasing the levels of carbon dioxide. These failed to gain any marks.
- (d) Rather than answer in the context of the question most candidates gave a basic description of the function of bile. Many failed to acknowledge the time values given in the results table and consequently omitted these details in their

answers. Some students relabelled test tubes A, B and C to 1, 2 and 3 in their responses which, although given the benefit of the doubt, was not considered a safe move to make. There were several responses that referred to 'bile making it easier for the enzyme to digest lipids' or 'lipase works more efficiently' which did not score a mark – the details given did not imply a faster reaction. More successful candidates tended to score, most often, at least one mark for including correct information on the effect of bile on the rate of reaction (marking point 1) although, as stated previously, the majority of these failed to include information drawn from the results given in the table.

Question 3

- (a)ii) Candidates named several gases in their answers to this question – nitrogen (most commonly), hydrogen and argon all of which were irrelevant and failed to score. There were many responses that were confused on the difference in composition between atmospheric air and air in the alveoli with a number of candidates stating that there was more oxygen and less carbon dioxide in alveolar air than in atmospheric air. Other responses gave just a list, for example, more oxygen, less carbon dioxide, lower temperature without stating whether they were referring to atmospheric or alveolar air. Many responses compared the amount of dust particles in alveolar and atmospheric air, stating that air was more 'pure' in the alveoli or gave details on pathogens that might be present. Many candidates included information about the differences in air pressure or used an incorrect formula for carbon dioxide. These failed to score. On the contrary, there were a good number of students that recognised alveolar air was warmer and/or more moist than atmospheric air and made a correct comparison of the concentrations of oxygen and carbon dioxide.
- (a)iii) There were many clearly structured answers to this question with students providing good information to score, in most cases, all three marks. Where full marks were not obtained, this was usually for stating that the alveoli were one cell thick rather than referring to their walls. Some students included information on surface area to volume ratio which was not credited and the most commonly missed answer was moist lining.
- (b) Too many students gave 'one cell thick' as an answer without implying that this referred to walls and this lost a significant number of marks. Several responses stated that it was 'close to the alveoli' or that it 'contained pores' which were not credited. Other incorrect answers gave details about the vessel only containing red blood cells whereas some responses mentioned the absence of valves. There were responses that gave a description using information drawn from the diagram of one red blood cells passing through at any one time and these were credited for the second marking point. Mostly, answers were vague with the majority of candidates gaining one mark for either 'thin walls' or 'narrow lumen' but rarely both

- (c) Most candidates identified a faster breathing rate as a consequence to the loss of elasticity in the alveoli walls although the vast majority appeared to not to be familiar with the effects of emphysema beyond this. An exceptionally small number of candidates were awarded a second mark by stating that exhalation was forced although this was a mark that was missed very frequently. There were a large number of responses that gave more information than what was expected by the question, discussing the effect on gas exchange and aerobic respiration rather than just focussing on breathing. These details failed to gain credit.

Question 4

- (ai) The graph was really well drawn in the majority of responses with most candidates gaining full marks. Missed marks were mostly due to lack of axes labels or for failing to add units to the time label on the X axis.
- (aii) Numerous responses failed to use the term 'volume' and preferred to state 'amount' for marking point 1 and these were not credited. There were several references to time without further clarification and, again, these failed to score. A good number of candidates included temperature as a control variable and many recognised that the mass (or more commonly 'amount') of carbohydrate, frequently named – either sucrose or starch - needed to remain constant.
- (b) There were some vague answers to this question where candidates had the right idea but did not support their details with information from the results table. For example, most recognised that the decrease in pH was associated with pain relief and that the faster the aspirin dissolved the more quickly pain was relieved. Responses of this nature were just a basic rewrite of the information already given to them in the question and could not be credited. However, a good number of candidates did recognise that the addition of sucrose to aspirin decreased the pH more quickly than it did with the addition of starch with these answers scoring a minimum of 2 marks.

Question 5

- (ai) There were some excellent answers to this question clearly indicating that candidates fully understood the functions of the different parts of the ear. All marking points were covered in many responses although marking point 3 was most commonly omitted.
- (aii) A large number of responses were structured clearly and gained full marks although there were many where spelling of structures caused confusion and failed to be credited. There were numerous responses that referred to the auditory nerve as the auditory canal (no mark) and several references were made to the inner or outer ear without being specific in the structures being referred to. Numerous responses listed the names of the ossicles which did not

gain any marks as these were shown in the diagram and there were many references to the oval and/or round window again not being given credit.

- (bi) This question was generally answered very well by candidates who understood that structures P, Q and R were involved in transmitting and amplifying vibrations from the eardrum to the cochlea. Responses were clearly written in most cases and gained full marks. Where candidates failed to score full marks it was simply a case of lack of detail although even in these responses, it was clear that students were clear on the functions of the parts in question. Details lacking mostly included marking points 3 and 4/5 which limited answers to 3 out of the 4 marks available.
- (d) Some candidates mistook structure S as the auditory nerve and gave details about transmitting nerve impulses to the brain and the consequences if the nerve was damaged. Others lost marks by stating that it equalised pressure either side of the ear rather than ear drum or equalised pressure inside the ear. There were, however, many good responses that gained at least two marks covering mark points 1 and 2. Marking point 3 was one that was commonly missed.

Question 6

- (bi/bii) There was a large variation in the calculations seen for these two questions, some of which were difficult interpret due to the way that some candidates presented their working out. 6bi was more successfully answered than 6bii where students were seemingly more challenged. Regardless of the answer given to 6bi candidates were not penalised in 6bii if the answer given to 6bi was used correctly in 6bii. It was rare to see any responses not gaining at least one mark for 6bi as most students identified that the weight of the man needed to be used in the calculation. Similarly, for 6bii a good number of responses deducted 75 from their previous answer to gain a mark but often failed to provide any further correct information.
- (c) There were a range of incorrect answers to this question mostly linked to the site of action of ADH. Many students were misconceived into thinking that ADH acted affected the kidney at sites other than the collecting duct and although kidney tubules came up several times in answers this was too vague. If these responses has specifically stated distal tubule then these would have been awarded although this was the never the case. Use of correct scientific terminology also lost students marks here were numerous responses used the term 'absorbed' rather than 'reabsorbed' when describing the action of ADH on water reabsorption. It appeared that some candidates were unable to distinguish between the meaning of these two words and many lost marks for simply stating that 'more water is absorbed'. Some poorly worded answers such as 'kidney absorbs more water' rather than specifying that more water was returned or reabsorbed into the blood were seen frequently and not awarded.

- (d) Some candidates used the term 'plasmolysed' or 'flaccid' to describe the change in red blood cells following water loss and as this term is only used with reference to plant cells this information was ignored and not given a mark. There were numerous vague answers that stated nothing more than the body loses water and, in some cases, responses included information about body cells losing water rather than focussing on the blood as the question asked.
- (e) This question posed a challenge even for the more able students who, at best, were able to score 2 marks. These marks were awarded for an understanding that less ADH was released and that this would reduce the amount of water reabsorbed. Most candidates failed to recognise that toxic waste products would continue to be produced and that these needed to be excreted in urine. There were a number of responses that just reworded the questions stating that 'only half of the water would be reabsorbed' and these failed to gain marks.

Question 7

- (a) There were many students that had difficulty in distinguishing whole blood from plasma with a large number of answers stating, for example, that plasma carried hormones, nutrients and numerous other substances without thinking that this was also true of whole blood. There were a fair number of responses that gained one mark, mostly for understanding that whole blood contained cells although a second mark was rarely obtained for including details about the colour of whole blood or plasma. A large number of candidates failed to recognise that plasma was a part of whole blood and, with this in mind, went on to list components that were present in both., For example, answers such as 'plasma contains antibodies/proteins/nutrients and so which is also true for whole blood.
- (b) It was disappointing that a large number of candidates detailed a basic immune response rather than the effect of injecting antibodies/plasma alone into a patient. Many responses described the role of memory cells and how these would provide immunity or instigate a secondary immune response in the patient or discuss the role of lymphocytes in producing antibodies either in the donor or the recipient. This information was given frequently despite the details in the question being quite clear about injecting plasma only into the patient. As seen frequently in previous examination series, students preferred to state that the antibodies or memory cells 'fight' the virus (Ebola) rather than destroy it. These details were not given credit. Few candidates provided information beyond giving details about memory cells and an immune response – they failed to provide any reason why other procedures carried out by the WHO were in place. For example, it was rare to see students providing a reason for screening blood or separating the plasma from the blood. Consequently, the maximum mark scored for answers rarely rose above 3.

Question 8

- (a) Coverage of the first two marking points in responses gained most students two marks for their answers to this question. Some understood that a mutation would change the type of protein produced in some way and there were various ways in which students presented this information – structure of the protein would change, and non-functional protein made were just a few. Few candidates gave details on a change in the phenotype or genotype of an individual for the last marking point although the students that did identify this marking point usually gained full marks. Some candidate responses lacked depth of information and simply mentioned ‘a change in DNA’ or ‘a change in a gene’ without exemplification.
- (bi) Typical errors in presentation lost students marks for this question, with the most frequent mark being lost was for aligning the phenotype of the offspring with the correct genotype. There were several candidates that gave the correct phenotypes in relation to haemophilia but then failed to state whether the offspring were male or female. A careless oversight. This meant that a good number of candidates scored only 3 of the 4 marks available for their response. Most candidates used the information given to them in the question to identify the correct parental genotypes, gametes and genotypes of offspring and it was pleasing to fully credit parent genotypes along with Punnett squares, rather than the traditional genetic diagram, that were fully labelled showing the correct information. Some candidates failed to gain marks for giving the incorrect genotypes for the parents, mostly due to not being able to distinguish between the male and female sex chromosomes rather than the alleles for haemophilia.
- (bii) Candidates often used 25% in their calculation for one mark although were mostly unaware of how to use this to calculate the probability that both children would inherit haemophilia. There were several answers that gained a second mark by presenting a correct multiplication ($\frac{1}{4} \times \frac{1}{4}$) but answers to this were varied. This implied that students were less familiar in working with fractions and less confident in how to carry out a multiplication using the fractions that they had derived. Final answers were, therefore, frequently incorrect although a fair number obtained 2 marks for showing clear working. There were many responses that simply added 25% + 25% to arrive at an answer of 50% and although these achieved one mark for marking point 1 they failed to gain further credit. Students gaining full marks expressed their answers in numerous ways and all options for marking point 3 were covered in these.
- (c) It appeared that many candidates, even the most able, felt it a challenge to provide details that clearly expressed their knowledge and understanding of the inheritance of cystic fibrosis. Most often, answers lacked clarity and/or detail that candidates tried to put into words, but which required too much interpretation to unravel and award marks. Most students understood that cystic fibrosis was a (homozygous) recessive disorder and that faulty allele was

carried on the X chromosome and, similarly, the majority also identified the male having only one X chromosome. The lack of clarity came when candidates then tried to provide information on exactly why the male could not be a carrier – either he had the disease, or he didn't. There was little information on two X chromosomes or H and h being needed to be a carrier and it was rare to see students provide details about the dominant allele masking the effects of the recessive allele. These marking points were, therefore, infrequently awarded.