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In Human Biology (4HB0) Paper 02

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Question 1

1ai

Answers were varied for this question although a good number of candidates were able to complete the boxes correctly for full marks. Most often, students were able to identify that water was present in blood, filtrate and urine and this was the most common correct answer for one mark. However, their understanding of whether the other substances were present or absent was less evident with urea seemingly the least understood.

1aii

Most candidates seemed conversant with this topic showing good understanding of the reasons why the composition of the fluids shown in the table would be different in a person with diabetes. Many candidates were able to state that more glucose would be found in the blood and/or found in urine and linked this idea to less reabsorption although the insulin mark was often omitted from responses. Students gaining two marks generally gave answers covering two of the last three marking points and few lost marks for confusing glycogen with glucagon.

1b

Candidates tended to come up with two of the three differences asked for but some struggled to find a third. Of these candidates most gave information that was unrelated to the composition of the blood in each of the vessels which is what the question asked for and these lost a mark by giving responses such as the renal vein does not pump blood/artery pumps blood or renal vein contains filtered blood/blood in artery is not filtered or that the renal vein contains less water and the artery contains more water. Other examples such as the renal vein has valves and the artery does not have valves or the renal vein has thin walls and the artery has thick walls were seen often. Some candidates were particularly vague in their answers giving information such as the renal vein contains less waste or nutrients and the renal artery contains more waste or nutrients or that salts were balanced in the renal vein and not balanced in the artery. Other incorrect responses were again vague and failed to provide a difference. For example, answers such as the renal vein contains carbon dioxide and the renal artery contains oxygen were not awarded.

1ci

Most candidates were able to correctly draw an arrow in or alongside the renal artery for one mark. Responses that failed to gain marks were, most commonly, those that drew the arrow the wrong way round and also those that drew arrows in both the vein and the artery.

1cii

The majority of candidates gave clear descriptions of the differences between the vein and artery for full marks although there were some that were unable to use appropriate terminology in the correct context or that failed to distinguish between the artery and the vein which often lost marks. Some candidates, for example, stated that the vein was thinner rather than it having thinner walls or that the artery was thicker. On other occasions responses such as 'the renal vein prevents backflow of blood' were seen without the mention of valves. More candidates preferred to state that arteries had thicker or vein had thinner walls rather than give details of elastic or muscular tissue although these details were acceptable. Candidates lost marks for describing differences other than those shown in the diagram – 'the blood pressure is higher in the artery than in the vein'

and 'the renal vein carries blood away from the kidney' were seen fairly often. Interestingly a fair number of candidates stated, for no credit, that 'the artery is straight whereas the vein isn't' focussing on the idea of the shape of the vessel as seen in the diagram rather than the expected structural differences to qualify for any marks.

Students should be reminded that when discussing differences a comparative answer is needed – the renal vein has less muscle in its walls than the renal artery is ideal but many candidates made blank statements such as 'the renal vein has thin walls'. Although this was accepted on this occasion and given the benefit of the doubt candidates should be encouraged to understand how to answer this type of question to secure marks.

Question 2

2aii

Candidates were confused in many cases on where to position their arrows on the diagram, more so for the vagina than any of the other two. Although most students appeared able to locate the ovary and oviduct, the label for the vagina was found in an assortment of areas on the diagram, mostly directed in the region of the uterus. Arrows placed on the cervix to indicate the location of the vagina were not awarded. In a few cases, the arrows indicating the location of the structures was placed correctly but the letter assigned to the arrow was incorrect which negated marks. Some label lines were precariously positioned which made it difficult to determine exactly what was being highlighted. Unfortunately these ambiguous responses were not credited.

2bi

Most candidates were able to identify the location of the testes and placed 'S' at the correct position on the diagram. Responses that failed to score a mark located the testes in various other locations on the diagram including the bladder, prostate gland and penis. The few responses that were left blank were likely due to students overlooking the question.

2bii

Some candidates were mistaken in thinking that a vasectomy prevented sperm being produced and many of these answers failed to gain marks due to their ambiguity. Similarly, marks were not awarded for the urethra or ureter being cut – responses of this sort were often seen implying a lack of understanding of the parts of the male reproductive system. However, most candidates scored at least one mark for stating that no fertilisation would take place. It appeared that most students were unfamiliar with the term 'vas deferens' as a variety of terms or phrases were used to describe what was actually cut during a vasectomy with 'sperm ducts' being the most popular response. Some answers were expressed poorly, particularly in relation to marking point 2 where many candidates failed to give a clear description that a vasectomy prevented sperm from being released from the penis and entering the female.

2biii

Most candidates were aware that gonorrhoea was a sexually transmitted disease but did not fully explain the transmission to gain full marks. A fair number of candidates failed to make it clear that contaminated fluid could still pass from the male to the female for the second marking point although

a good number of students were able to gain a mark by showing understanding that gonorrhoea was transmitted via mixing of body fluids. Several candidates discussed how gonorrhoea could be prevented by wearing condoms and others mentioned how sperm were not involved in its transfer although responses of this nature did not gain marks. Several candidates were vague and described any skin to skin contact could spread the disease and others described reversing the direction of spread of gonorrhoea through infected female body fluids to the male body fluid via sexual intercourse. Again, these responses were not credited.

Question 3

3bi

It was apparent in many of the responses seen that candidates were unsure of the different stages of the cell cycle – a fair number gave responses that made it clear that they thought DNA replication was part of mitosis itself rather than an event that took place prior mitosis. This led to many responses lacking clarity and consequently failing to gain marks despite mention of mitosis in their responses. Most candidates were able to state simply for one mark that the amount of DNA doubles or that the amount of DNA increases from 2 to 4 arbitrary units and most commonly, for the second mark where it was awarded, candidates mentioned DNA replication. Vague response such as 'DNA increases' were not awarded. Other responses along similar lines also failed to provide adequate detail. For example 'DNA increases due to cell division' or more simply 'the genetic material between X and Y increases' which were seen frequently failed to gain any marks. Responses that were also not awarded were those that just simply described the shape of the graph rather than give an explanation for the change in the amount of genetic material.

3bii

Few 3 mark answers were seen in responses by candidates who most often only stated that the amount of DNA/genetic material had returned to 'normal' without attempting any further clarification of what they meant by this. Some candidates' responses were vague, giving information that was just the reverse of what might have been stated in the previous question i.e. the amount of genetic material drops from 4 to 2 arbitrary units and then remains constant was a particularly popular response. There appeared to be some confusion with meiosis here where candidates discussed 'halving' of genetic information without making it clear that this was from the 'doubling' point. These responses were ambiguous and not awarded credit.

3biii

Too many candidates failed to read the instructions given in the question carefully and attempted to draw all manner of lines that did not extend from the one shown on the diagram. This lost many marks. Few students scored full marks and those that scored 2 drew either a vertical or diagonal line downwards stopping at 1 arbitrary unit.

3biv

Candidates working at grade C and above mostly understood that meiosis had occurred forming haploid cells or cells containing half the number of chromosomes and gave descriptions that clearly described a correctly drawn line on the graph (previous question). More able candidates, therefore, did

not find this question challenging although those working at lower grades managed to obtain, at best, one of the marks available. The fact that 4 new cells were produced was the least awarded being the most commonly omitted from responses. Some candidates that failed to score any marks were clearly unsure of why they had drawn the line on the graph in the way that they had and consequently were unable to give a creditworthy explanation. However, despite this question hinging on correct interpretation of the previous question, many candidates were helped by the question where it stated 'include the production of gametes in your answer'. This prompted several one mark responses that linked the production of gametes with 'meiosis' which was a common one mark answer.

Question 4

4aii

A good number of candidates were able to relay their understanding of the conditions in the stomach and gave details in their responses that related to this. Others conveyed understanding that the hydrochloric acid provided the optimum pH for pepsin or that pepsin worked best at pH2. These responses gained one mark. Some candidates referred to temperature rather than pH and few responses were confused about low pH/high acidity which meant that marks were lost. There were several responses that linked the addition of hydrochloric acid to bacteria – 'to kill bacteria' or 'to get rid of germs' were seen fairly often. These failed to gain credit.

4aiii

Inadequate terminology was seen frequently to describe the action of pepsin on the protein in the test tube. Pepsin 'converts' proteins rather than breaks down or digests was common and several candidates gave clear descriptions of the mode of action of the enzyme by reciting the lock and key hypothesis including details of the substrate binding to the active site without relating any detail to the investigation carried out. A fair number of students tried explain the observations in tubes A and B by referring to temperature and how this affects enzyme activity despite the preliminary information given to candidates stating that the temperature during the investigation was maintained at 37 °C. There was little mention of proteins being broken down to 'amino acids' with most candidates overlooking this marking point and gaining their marks for details covering other areas of the markscheme. The least common detail in responses was that relating to the last marking point. Many candidates referred to the hydrochloric acid dissolving the egg white rather than the pepsin digesting it and based their answer around this idea for no marks.

Some students discussed surface area to volume ratio rather than just surface area and despite responses hinting at some understanding their use of terminology was such that it rendered answers ambiguous and therefore non-creditworthy. There was some confusion that the larger pieces of egg white gave a large surface area and vice versa which also failed to gain marks.

Candidates often covered the same marking point more than once in their answer e.g. the egg white in tube A has a small surface area and therefore it took more time to break down and the egg white in tube B has a large surface area and took less time to break down. These responses were only

awarded 2 out of the 4 available marks if no other relevant content was given.

4aiv

Most candidates failed to link the positive protein test with the enzyme, pepsin, still being present in the test tube and therefore many failed to score any marks for their answers to this question. Responses were mainly based on protein still being present i.e. the egg white or that the protein was broken down to amino acids which are still a protein (which therefore gave a positive result). These were. Some students wasted time in giving irrelevant details of the outcomes of a biuret test i.e. that a lilac/purple colour would be present. Few candidates were able to score one mark for understanding that incomplete digestion may have taken place although this marking point was most common.

4bi

This question was answered well by the majority of candidates whose responses gave clear explanations of the results of the investigation for tube C after 30 minutes. Candidates that gained one mark generally omitted details about the absence of pepsin and gained a mark for stating that the egg white would not be broken down/still present. Most realised that the acid alone would have no or little effect on the egg white. Some pupils incorrectly gave details about osmosis.

4bii

This was another question that was answered well by candidates. The majority understood that tube C was set up as a control for one mark and most went on to cover the second marking point by stating that it helped to prove that the enzyme was responsible for protein digestion. Some candidates failed to score marks for stating that tube C was included to make it a fair test. The most common incorrect responses generally tended to state that Tube C was a control variable rather than just a control implying that students were unable to distinguish between these two terms.

Question 5

Students generally scored very well on this question with many gaining at least 6 out of the 9 available marks although a good number of candidates gained full marks. Where errors were made, these were most often in the first section where candidates tended to lose marks for giving cytoplasm rather than mitochondria for the site of aerobic respiration and also failing to give the full details for ADP, frequently giving just adenosine or adenine. Other candidates were unable to give the names or abbreviations for either of these energy giving compounds but instead answered by giving information that was not awarded such as protein, DNA, sugar, oxygen, blood, sweat, respiration or just triphosphate amongst others.

A fair number of students misunderstood how energy was released and gave chemical or kinetic as unacceptable alternatives to heat or thermal energy. Similarly, several candidates were unable to name the location in the body where lactic acid was broken down and instead gave its site of production – muscle. A few candidates thought that lactic acid or just oxygen needed to be repaid rather than the oxygen debt, the latter often being spelt oxygen dept although the benefit of the doubt was given in these cases despite the alternative meaning. Even more candidates were

misconceived into thinking that it was 'carbon dioxide' that had to be repaid.

