



Examiners' Report
Principal Examiner Feedback

January 2023

Pearson Edexcel International GCSE
In Human Biology (4HB1) Paper 02

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Overview

There were a fair number of excellent answers across most of the questions on the paper with students using good scientific terminology and detail in responses that reflected strong knowledge and understanding for the most part. On the contrary, there were some descriptions and explanations, including analyses and conclusions that were disappointing. Candidates struggled interpreting the graph and many extracted the incorrect figures which limited the score that they obtained. Similarly, very few students were able to complete a graph successfully or carry out calculations as well as what candidates have done in previous examination series. There were also common areas of Human Biology where students seemed to lack knowledge and/or understanding and these were highlighted time and time again in lengthy responses that failed to gain any marks.

Question 1

1ai There were a surprising number of incorrectly labelled structures, mostly being the scapula and clavicle although some candidates also labelled the septum (and even the humerus) as the vertebral column. Most candidates gained at least one mark for identifying the vertebral column although some confused this with the sternum.

1aai Most commonly, candidates obtained one mark for describing how the axial skeleton provided protection and alongside these details further information was often given on the body organs being protected. Some students gave rather vague answers such as 'it gives us shape' or 'keeps us upright' which is not the same as providing support. These details failed to gain credit as did those that just described the structure of the axial skeleton.

1b All marking points were covered across the range of responses seen although descriptions that included information on how osteoporosis affects height, posture or caused stooping were less common. Many candidates gained 2 marks for their answer with responses reflecting a good understanding of the effects of this condition on the body. Students were aware that bones were weakened and that broke (or fractured) easily and likewise, they were also aware that osteoporosis caused a decrease in bone mass or density. The third mark was most often obtained by some for making reference to pain. There were several references to muscles which were not awarded.

Question 2

2aai The vast majority of candidates were able to describe the function of structure X although many omitted to mention that this structure was a valve. This meant that many responses were restricted to one mark. However, when the valve was given, there were some candidates that named it incorrectly although on this occasion there was no penalty, and the mark was awarded.

2aiv the lungs was by far the most popular correct answer even though a fair proportion of candidates chose to give the pulmonary vein as a response. Incorrect responses were varied but included structures such as the left atrium, pulmonary artery, vena cava or just simply stated 'from the body' or 'from other organs'.

2b This was, overall, a well-answered question with popular choices for answers being tissue rejection and a damaged or diseased heart with names of several valid diseases or abnormalities mentioned. Some candidates repeated the same marking point twice. For example, tissue rejection and references to tissue or blood types not matching were commonly stated in the same answer. These responses were only awarded one mark. In all responses seen, no student was able to state that the heart may have been removed from the donor for too long.

2cii Probably more than 70% of students identified that no fibrin would be produced in the absence of thrombin. However, of this number only a minority were able to gain a second mark by linking fibrin to being a substrate for factor XIII although some candidates were more successful and were able to describe how a mesh would not be formed for a second mark. There was unfortunate choice of wording by some students who just repeated the stem of the question and unless the lack of a blood clot forming was linked to fibrin not being produced no credit was given. Other responses that failed to gain marks were those that simply described the blood clotting process without putting these details into the context of the question.

Question 3

3ai Students were mostly able to calculate the volume of the agar cube but were challenged with the process of calculating its surface area. It was evident in several cases that students lacked practice in this type of calculation, and this led, unfortunately, to lost marks. However, there were many 3-mark responses that showed clearly displayed working out with correct units added to figures although there was some confusion over units. Some students gave the units for volume to surface area and vice versa.

3aiii Mostly correct answers for this one-mark question. Incorrect responses included 'when particles mix and move', 'particles moving from high water potential to a low water potential' and the customary switch in direction in responses that decided that diffusion was the movement of particles from a 'low concentration to a high concentration'.

3aiv Several candidates appeared to not understand the effect of surface area:volume on transport by diffusion as they made reference to the diffusion rate decreasing due to the increase in size of the cube. There was little information given that related to the diffusion distance decreasing with a few more students describing, in various ways, that the area over which particles can diffuse would increase. Mostly, candidates scored one mark for identifying a decrease in the rate of diffusion. The second marking point was seen much less often.

3bi Some good examples were seen of detailed and clearly written methods to test the effect of temperature on the rate of diffusion. Many candidates gained the full 2 marks for their responses. There was some information given in other answers that failed to make it explicit that *different* temperatures were being tested. For example, 'place the test tube in a waterbath at 40°C' without making it clear that diffusion rate would be tested at a least one other temperature did not gain a mark. However, even these answers tended to gain one mark for relaying the understanding that the diffusion rate needed to be measured or compared. Students that stated 'observe the colour change' or 'observe the change from pink to colourless' were not awarded the second marking point.

3bii It was pleasing to see a greater number of students using the term 'volume' rather 'amount' for marking points 2 and 3. Use of the term 'amount' in responses referring to acid or alkali was not awarded. Students should be made aware that they need to be specific in what they are relating to in their answers. For example, 'volume of solutions' was mentioned several times without making any reference to a particular solution used in the practical. There were several candidates that identified surface area:volume as a control and others made references to the size or mass of the cube for one mark. The most common incorrect answer given was temperature indicating some confusion between the different variables.

Question 4

4ai Responses to this question were very varied, ranging from those not being awarded at all to those gaining full marks. The distribution of one- and two-mark questions was fairly uniform although 3-mark responses were seen often. Candidates often failed to clearly state whether the details they gave were referring to the blood or to tissue fluid so these could not be awarded. There were several responses from candidates who were not specific enough in their language. For example, stating blood cells rather than red blood cells appeared in some answers. It also seems that candidates are not entirely sure of differences between blood and tissue fluid and a vast majority failed to state that tissue fluid did not contain *plasma* proteins – many just stated proteins which was not credited. A fair number of candidates were able to state that tissue fluid did not contain red blood cells, and a few picked up a further mark for identifying that it also contained less oxygen and/or more carbon dioxide.

4aii Overall, this was not a well-answered question with many candidates struggling to gain more than one mark. Some students were able to state that capillaries had pores but were then stretched to come up with any further details that could be credited. Very few candidates showed any knowledge that water was forced out of the blood with many responses referring instead to plasma.

4aiii This was another poorly answered question with most students linking blood flow to muscle contraction and increased aerobic respiration rather than the effect of contraction on the movement of tissue fluid in the lymphatic system. Candidates were also unable to state that the excess fluid drains in through the lymph – it was exceptionally rare to award this mark.

4b Candidates often referred to antibodies as enzymes with an active site specific to an antigen. Details were given of the Lock and Key hypothesis in some responses which attempted to define specificity between the antibody and antigen but did not quite get there. There was little mention of the antibody having a variable region although some students identified them as receptors which would bind to the antigen. There was little discussion in responses given by more able students about the shape of the receptors being complementary although the language used in some of these made answers difficult to interpret. Of the four marking points available for this question, students were mostly gaining 2 marks covering, most often, marking points 3 and 4.

Question 5

5ai Most candidates were familiar with the symbol equation for aerobic respiration. Incorrect answers mostly muddled the balancing but others mixed word and symbol equations, gave the

wrong formulae for the reactants and/or products or just wrote them incorrectly switching upper case to lower case.

5aii Another well-answered question by most who were awarded full marks for stating that ATP was broken down to release ADP and P(i). One-mark responses tended to omit the phosphate group and those not scoring gave answers that varied from describing aerobic respiration, breaking down ADP to ATP to ATP makes glucose.

5bi There were very few graphs that failed to gain full marks. The vast majority were clearly laid out and easy to award with the only errors appearing in the scales given by some students and the occasional omission of one or more of the axes labels or the axes labels the wrong way round. Where scales were incorrect, candidates tended to use figures directly from the table on the X and Y axis and it was unfortunate for some that incorrectly written scales had a knock on effect to points plotted.

5bii Candidates struggled with drawing a curve of best fit through the point plotted on the graph. The vast majority of responses just joined the dots and were, therefore, not credited.

5biii This question was answered particularly well by many students who gave detailed and well-structured accounts of how the percentage change in mass of haemoglobin would benefit performance during exercise. There were many 5-mark answers that reflected sound knowledge and understanding of the role of haemoglobin and the bodily processes involved that would increase performance. Most frequently, marking points 2, 5 and 7 were overlooked by candidates. For marking point 5 several responses referred to just cells rather than muscle (cells or tissue) and some details given for marking point were sometimes too vague to award. Some candidates referred to the production of ATP as an alternative to marking point 7 and there was frequent mention of oxyhaemoglobin which was awarded an alternative to marking point 3. There were a few candidates that just described the data of the graph which did not answer the question.

Question 6

6ai It was a challenge for some students to gain all 3 marks for their answer to this question. Most were able to link using the patient's own cells with a reduced risk of rejection although other marking points were less often seen in responses. Some candidates understood a benefit of using the patient's own iPS cells reduced the need to use embryo's although students preferred to state that less embryo's would be destroyed. There were a few responses that missed out on this marking point. For example, 'As the patient's own cells are being used there are no moral or ethical issues'. Marking point 2 wasn't particularly popular in the responses seen although few students mentioned that there would be no need to find a donor.

6aii The information coming across in responses implied a fair understanding of the risks of using stem cells to treat disease. Most commonly students identified that the use of stem cells could lead to cancer or an increased risk of infection although few answers mentioned the use of unlicensed clinics, an easy mark with information that could have been derived from the passage with a little more thought.

6bi There were a good deal of students that failed to use the correct figures in a calculation as they had incorrectly interpreted the scale on the graph. Although an error carried forward was

allowed in this case it did mean that these candidates missed out on a mark. There were some figures quoted in the working out shown by the student that were so far detached from what was shown on the graph that it was impossible to interpret their thinking. Other students simply read from the wrong bar on the graph which was an unnecessary oversight. There were occasions where the correct working was clearly shown along with the correct answer, but an alternative final value was given on the answer line or the value shown had the incorrect number of zeros.

6c It appeared that some candidates had no knowledge at all of genetic modification and gained no marks in discussing selective breeding as an alternative. Few responses mentioned Golden Rice and a fair number of answers gave incorrect information that referred to the vitamin A gene being cut from humans or from rice. Marks gained were often linked to the use of restriction enzymes and inserting the gene for vitamin A into the plant.

Question 7

7bi Rather than describe how urea is produced, some candidates simply described what it was made up of. A fair number of responses incorrectly stated that it was formed in the kidneys rather than the liver. There were candidates that discussed how amino acids were converted into carbohydrates and lipids or that urea was obtained from food or from the air. Some candidates made the mistake of stating that it was produced from the breakdown of protein. Less able candidates really struggled with this question and were very unlikely to gain any mark at all. There were some excellent responses from higher ability students who used scientific terminology well, giving details beyond the expectations of the mark scheme. These answers frequently gained full marks.

7bii Some candidates gave very detailed accounts that included all the right structures and terminology and most of these would have gained full marks if they had not muddled information on ADH production. Several of these responses remarked on how less ADH was released if the blood had a lower water potential and vice versa leading to confusion that negated marks that might otherwise have been given. There were a few answers that were very unclear on which sample was being referred to and these could not be awarded. Many students were able to use at least some information from the table to support their responses and compared the components of the first and second samples for marking point 1. Where responses came close to covering the last marking point, marks were lost for not clearly stating that water was *reabsorbed* or that water was absorbed *back into the blood*. Candidates working at the higher grades produced excellent detail often gaining full marks.

Question 8

8ai There were a number of responses that described the role of LH as stimulating oestrogen production or causing the follicle, rather the egg, to be released from the ovary. Most candidates, however, were able to identify the correct role of this hormone for one mark.

8aii Many answers given by candidates gained at least 2 of the 3 marks available. These candidates were most often able to link an increase in FSH with more eggs being produced and more than one egg being released with students gaining a third mark also stating that more than one egg

could be fertilised. The range of answers given by less able students gaining one mark spanned across the marking points with marking point 1 being the least popular.

8bi The vast majority of candidates came across with the idea that the nutrients were shared between the twins although many stopped at this point and completed their answer by repeating the stem of the question 'so have lower birth mass'. Very few students gave details about the placenta supplying glucose/oxygen from the mother – most just mentioned that the twins received nutrients from the mother. Although some candidates correctly stated that less aerobic respiration would take place this was rarely linked to a lack of energy for growth.

8bii There were several answers took up most of the allocated space just rewording the question, describing how the twins had the same genes because they were from the same zygote and therefore genetically identical. There were very few mentions of the zygote splitting and even less mention of 2 embryos being formed. It seemed that only the most able candidates were able to gain at least two marks and seeing a 3-mark response was very rare. Across the whole ability range, the most popular correct answer was that the same egg and sperm were used, and this gave a fair number of students one mark.

8cii Poorly structured answers and lack of concise detail cost some students marks. Many candidates seemed unaware that the mass of the baby should be measured and only a small handful of responses described how the mass should be compared to others of the same age. There were some candidates who were on the right lines, but lack of clarity and detail rendered their answers dubious and open to interpretation.

Summary

There were several areas in the paper where candidates lost marks but really didn't need to. For example, a question asking for two examples was met by a long list written by some pupils which could have forsaken marks. Candidates clearly need practice in drawing curves of best fit and although the vast majority did attempt to have a go (with some drawing straight lines) many were incorrect. Similarly, many had issues with determining the scale on one graph given in the paper and consequently arrived at incorrect values to plug into a calculation, again costing marks. Question 4 was particularly challenging for candidates of all abilities. Few marks were gained overall for the four questions in this section. Answers made it quite clear that there was a widespread deficit in knowledge and understanding in this topic area, something that may need to be addressed for future examination series. Question 5biii was particularly well-answered by candidates of all abilities – it was rare for any student not to score at all for their efforts.

