

Examiners' Report/
Principal Examiner Feedback

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Pearson Edexcel International GCSE
In Human Biology (4HB0) Paper 2

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Question 1

1ai – Many candidates guessed their answer to this question and named diseases, mostly within the specification, that were not caused by bacteria. Examples most commonly included influenza and malaria although HIV, and less frequently polio and schistosomiasis, were also mentioned. Other candidates correctly stated the name of disease caused by a bacteria but then also gave the name of a bacterium which, if correct was ignored, but if incorrect negated the correct answer. Some candidates just stated the name of a bacterium which was not awarded. There were several responses that just described the symptoms of a disease. Of these, diarrhoea was the most common. The most popular correct answer was typhoid closely followed by tuberculosis. Gonorrhoea was infrequently given as an answer.

1aii – This question was generally answered very well with very few candidates failing to score the mark. The most common correct responses were limited to thrush and athlete's foot although ringworm was also seen, albeit rarely. Of the candidates that were unsuccessful in their response, most made the same mistakes as those seen in the previous question i.e. naming a disease not caused by a fungus.

1bi – This question proved a challenge for many candidates and despite having a diagram for support only a handful of candidates correctly identified parasites as the organisms that obtain nutrients from a living person. The most frequently written incorrect answers were bacteria, virus and pathogens with these being seen on a significantly larger number of occasions than the correct answer.

1bii – Full marks were not often awarded responses to this item indicating a widespread misunderstanding of not just the food-substances that disease-causing organisms obtain from human blood but also the state of substances found in human blood. The majority of candidates were clearly unaware that carbohydrates, being complex, insoluble molecules, are not carried in the blood and likewise for fats although these two substances cropped up often in responses. Protein was also a very common incorrect answer and although there are numerous blood proteins these are not the type that provide a food source for disease-causing organisms. Candidates obtaining one mark for their answer generally gained this for stating glucose, with the few candidates scoring the full two marks also correctly identifying amino acids for a second mark. Some candidates gave a list of more than two food substances and unfortunately negated any correct marks that they had obtained by including incorrect answers in their list. The numerous candidates that mentioned oxygen either misinterpreted the question or were unclear of what was meant by 'food substance'.

1biii – A well-scoring question with the vast majority of candidates correctly identifying the two types of blood cell. Most of the students preferred not to use the more scientific terms for these cell types in their answer and tended to opt for white blood cell (although often given as 'phagocyte') and red blood cell. Very few candidates did not score although responses from these students appeared to be just guesses at what the structures represented with answers ranging from bacteria or viruses to various cells components such as cytoplasm or nucleus. Candidates that scored one

mark most frequently gave 'lymphocytes' rather than red blood cell and some candidates lost one mark for stating 'white blood cell' but then also giving 'leucocytes' as an alternative although these were infrequent. Students should be discouraged from using abbreviations such as RBC for red blood cell which was not awarded at all.

1biv – Most candidates scored well on this question by identifying the differences in structure between the two cell types. Errors in responses mostly occurred where candidates made a statement about only one feature of a particular cell i.e. the shape, such as 'the red blood cell is biconcave and the white blood cell is not' or 'the white blood cell has a nucleus and the red blood cell has not' and possibly believing this to be enough for the two marks. However, there were very few one mark answers and even less that failed to score at all. The clarity in which candidates expressed their answers suggested a good understanding of the differences between the red and white blood cell despite having the diagram to prompt them.

1bv – This question was answered less well than the previous with some candidates coming unstuck in their description of the role of the white blood cell in particular. Consequently, this item saw more one mark answers than the previous question where candidates either expressed their understanding using unacceptable terms e.g. protect against *germs* or *fight* infection or that gave descriptions which simply communicated a lack of knowledge of the role of the white blood cell shown in the diagram. However, similar to the previous question, the majority of the responses given gained two marks for detailing a correct function for each of the cell types including good descriptions of phagocytosis by white blood cells and oxygen transport by the red blood cells.

1bvi - The vast majority of candidates recognised blood component X as platelets with the rare, but most common incorrect answer being white blood cell. Other incorrect answers included plasma and, more often, antibodies.

1bvii – Where candidates gained a mark for the previous question, they inevitably scored well on this item, most gaining full marks for describing the role of platelets in the blood. The majority of responses portrayed a very good understanding of the role of this blood component although it was unfortunate in a fair number of cases that some candidates gave a detailed explanation of how platelets work rather than a description as stated in the question. It is very important that students are well aware of the distinction between describe and explain as common command words in a question – several candidates, who clearly understood the role of platelets, lost marks for giving a more complex, higher-level knowledge based answer involving the cascade of events that lead to a formation of a blood clot for one mark rather than the simple description that was expected for the marks. Few candidates gave the incorrect function for platelets although those that were unsuccessful tended to mix up their role with that of white blood cells i.e. antibody production and immunity.

Question 2

2a ii – A well-scoring question. The vast majority of candidates were able to correctly describe the change in the limewater brought about by the presence of carbon dioxide. The few candidates that did not score this mark were vague in their answers and gave responses such as 'there was a change in the limewater' or 'the limewater changed colour' or 'the *level* of limewater changed' although these errors were very infrequent.

2b – Most candidates scored three marks for this question, mainly for their understanding of aerobic respiration rather than their ability to apply this process to the observations made in the investigation. These candidates recognised that oxygen was used up by bacteria during respiration and for the third mark that carbon dioxide was released or that the volume of gas in the flask decreased. Candidates scoring a fourth mark were mostly able to link a drop in pressure to the fate of the gases in the flask. Although a number of students made an attempt to describe how the change in the volume of gases in the flask affected the pressure inside the container they were unable to provide enough clarity in their response to gain credit. In this case candidates used phrases such as 'a suction/vacuum was created' or 'the change in gases sucked the liquid along the tube' which were either incorrect or included the use of terminology that was not acceptable.

2c i – The number of candidates gaining a mark for stating temperature was roughly equal to the number of candidates not scoring for their response to this question. Students that were unsuccessful misinterpreted the question and provided a response that would have been more suited to a question asking about variables in a repeat of the experiment shown in the question. For example, the volume of limewater, mass of soil and less frequently the level of liquid in the glass tube were common answers. The question asked for one variable that should be kept constant *during* the investigation, not if the investigation was to be repeated.

2c ii – Candidates that failed to score on the previous question were unlikely to score on this question. However, those that did identify temperature as the variable that must be controlled generally understood that it would affect bacteria in some way. The vast majority of candidates that understood that bacteria would be affected by a change in temperature gave details about enzyme activity and denaturation which did not answer the question and no further details were provided on how this would have affected the observations made during the investigation. Similarly, some candidates stated that bacteria would be inactive at low temperatures or die at higher temperatures or just that the rate of reaction would change with some going further to provide details on the kinetic theory. A very small minority of candidates were able to conclude that the temperature would affect the rate of respiration and consequently cause a change in the level of fluid in the tube.

2d – This question caused some confusion for a large number of candidates who gave details of a vast array of experiments that they thought could be done to prove that the bacteria in the soil caused the change in the level of the liquid. These candidates clearly did not realise that changing anything

other than the presence of soil containing the bacteria would not give valid results. Some students attempted to explain why the level of the liquid changed and had clearly misread the question. Few candidates realised that it was simply a case of repeating the experiment without the bacteria and that this would act as a control to compare to the original test. Candidates that scored two marks gained these for recognising that the same equipment was needed but without the soil containing the bacteria or minus the bacteria alone. However, many of these failed to state that the results of this test would need to be compared to the original set and also neglected to describe how they would compare i.e. there would be a different or no change in the level of the liquid. Three marks were infrequently given.

Question 3

3 – The number of marks awarded for this item varied significantly with only the better candidates gaining full marks. Most commonly, details on hydrogen bonding and an adequate description of the shape of the DNA molecule i.e. coiled or spiral-shaped were omitted from responses that prevented many candidates gaining full marks. A number of descriptions were particularly well written. These responses included details on nucleotides (and their structure), complementary base-pairing and the helical structure of DNA for at least 7 marks. A surprisingly large number of candidates failed to mention that DNA was a double-helix although many managed to recall that it was made up of two strands. Some candidates abbreviated the names of the bases (A,G,T,C) rather than writing out their names in full. In this case, leniency was given and candidates were awarded marks for giving the correct base-pairing if it was mentioned but were not given the mark for naming the bases. Students should be discouraged from deviating from the topic of the question in their responses. Many candidates discussed how DNA replicated, its function and/or its location which were irrelevant and served only as a distraction from the creditable content of their answers.

Question 4

4a – Some candidates struggled in trying to define codominance. Many responses lacked clarity and focussed on genes rather than alleles showing codominance with numerous answers discussing two dominant alleles co-existing without clearly stating that neither was dominant over the other. Several poorly phrased answers included 'both are dominant over each other' which was ambiguous and therefore failed to score. The majority of responses that did score gained one mark for stating that codominance resulted in both alleles/characteristics being expressed equally (in the phenotype) or words to this effect and this particular feature was well understood by the majority of candidates.

4b – The responses to this question implied a general lack of understanding of sex-linked inheritance with too many seeming to guess the meaning of the term. Many definitions revolved around sex inheritance or diseases

transmitted through sexual intercourse rather than sex-linked diseases or diseases carried by the sex chromosomes whereas the obscurity of others e.g. connected to the sex of parents or related to the sex chromosomes/gender failed to gain marks. Some candidates identified that faulty alleles on the X or sex chromosomes were involved for one mark but failed to mention that the faulty allele was *inherited* for the second mark.

4c – This question generated some excellent answers indicating a thorough understanding of the inheritance of blood group. Many candidates scored full marks for clearly displayed and labelled genetic diagrams and where Punnett squares were used, these were usually in addition to a genetic diagram. Candidates that did choose to present their answer solely as a Punnett square generally restricted their total mark to two – one for showing the gametes and the other for the offspring genotypes. The most commonly missed mark for all candidates was the offspring phenotypes despite well drawn genetic diagrams and/or Punnett squares. Students that were unable to elucidate the parent genotypes from the information given in the question were generally unable to score any marks at all and some candidates failed to include the 'O' allele in their diagrams which meant that marks were lost. Although, on the whole this was a well-answered question, it should be noted that some diagrams were not laid out in a logical manner which made them difficult to follow. This, in some cases, led to marks being lost as they were for diagrams which were so small that it was impossible to determine what had been written. Candidates should also be made aware that they should make it absolutely clear what they wished to be marked. Several students gave alternative answers e.g. a partially incorrect genetic diagram but a correct Punnett square. Answers of this nature were marked incorrect – it is the responsibility of the candidate to ensure that they present only what is to be considered by the examiner. Few diagrams were presented unlabelled making the stages in the production of the offspring ambiguous. As most diagrams were laid out clearly, this did not pose too much of a problem for most of the time but a minority of candidates may have gained more marks for their answers if their diagrams had been fully labelled.

4di/4dii – Candidates that presented their response as either a percentage or a fraction usually gained a mark for both parts of this question although many gave 0% as their answer to 4di. The alternative ways of expressing the probabilities were less successful, particularly for 4dii where a vast majority of candidates gave 1:2 instead of 1 in 2. This highlighted a misunderstanding of ratios and many marks were lost because of this across the cohort. Some candidates gave more than one way of expressing the probability and in some cases gave an incorrect response in their list that negated the mark given for the correct response. For example 50% and 1:2 were often seen together as a response to 4dii.

Question 5

5a – This was generally a well answered question with many candidates clearly showing their understanding of the digestive system and gaining full marks for their response. Candidates that scored four marks mostly failed

to recall where the process of protein digestion begins and gave various responses which spanned the list of options available to them although 'H' cropped up regularly. Nearly all students were able to recall where bile is stored and this was the most common answer for candidates scoring 1 mark. However, low-scoring responses were very rare with the minimum score more often being three marks out of the five available.

5b – Many candidates scored two marks for their response to this item with the majority of students failing to include details about the contractions *pushing* food. Most tended to repeat the stem of the question stating that the contractions moved food along the tube (towards the stomach). Some candidates recognised that muscles were involved and included the names of the muscles but failed to state that they *contract*. Others gave good descriptions of how food is moved through the oesophagus, including accurate and thorough detail on longitudinal and circular muscles, but did not link their action to *peristalsis*.

Question 6

6a – The overall success of the responses for this question was mostly disappointing. Many candidates implied some understanding of water potential and concentration gradients but went little further than providing a definition of osmosis. Applying this understanding to the situation in the tube shown in the diagram was frequently omitted with candidates far too often not even mentioning side A or B. A typical response would be limited to 'water moves from a high water potential to a low water potential by osmosis' and several candidates referred to the *concentration* of water either side of the membrane which was not awarded. Other responses contained all of the necessary information but neglected to link it coherently to explain the movement of water across the membrane and others discussed the volume of the solution or the level of the water in side A rather than the percentage of water as asked for by the question. The vast majority of candidates scoring 2 out of the 3 marks were awarded for coverage of the first two marking points in their response but most were unable to state in the correct terms that the percentage of water increased or omitted this point completely.

6b – Many candidates gave good responses worthy of the full two marks. They were clear in their understanding that the protein molecules were too large to diffuse through the partially permeable membrane which resulted in no change in the percentage of protein in side B. There were very few one mark answers for this question as students that were unsuccessful tended to state that the protein would diffuse through the membrane and therefore its concentration in side B would increase. Some candidates failed to discuss protein altogether and focussed their response on the movement and 'concentration' of water either side of the membrane which obviously did not answer the question. Those that did gain one mark generally stated that the protein concentration would remain the same without supporting their statement with any explanation.

6c – Responses to this question were similar to those given for the previous question. More able candidates were able to conclude that the protein

concentration would decrease due to an increase in water but too many candidates went into fair detail describing the passage of protein across the membrane and even went as far as estimating the percentages of protein either side of the membrane. Some candidates, who were aware that the protein molecules were too large to travel across the membrane, stated that the protein concentration would stay the same which implied some misunderstanding of the effect of an increased amount of water (gained from side B) on the composition of the protein solution in side A.

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