

Examiners' Report/
Principal Examiner Feedback

Summer 2015

Pearson Edexcel International GCSE
in Human Biology (4HB0) Paper 02

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Publications Code UG041849

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Question 1

In question 1 (a) (i) most candidates were able to correctly label the heart with arrows showing the direction of blood flow through the blood vessels. A fair number of candidates left this question blank – either because they were not sure how to complete the question or because they had overlooked the question completely. One mark was obtained by a sizeable number of candidates who were able to give the direction of two arrows correctly.

Question 1 (a) (ii) was answered well by the vast majority of candidates who were able to score the full four marks for correctly naming the four blood vessels of the heart. Few candidates were confused and gave the names of vessels other than those required. Hepatic or renal vein were common errors that were most often given as an alternative to the vena cava and in some of these cases it was apparent that candidates had confused the capillaries at the base of the diagram with the liver – several candidates had actually labelled these capillaries, on the examination paper, as the liver. Some candidates were clearly aware of the names of the four blood vessels but were unable to match these to the correct letters shown on the diagram whereas others just gave the names of different parts of the heart e.g. atrium and ventricle for no marks.

It seemed in question (a) (iii) that a fair proportion of candidates failed to read the question properly and, rather than describe the differences between the structures of the two blood vessels, gave unrelated details on their function. Many responses included information such as 'carries deoxygenated blood' or 'carries blood away from the heart' or that vessel C carried blood under higher pressure. Several responses failed to clarify which vessel was being described or missed out on marks for vague answers such as 'they have different sized lumens' or gave responses that covered the same marking point such as 'C has a small lumen and D has a large lumen', without providing further information. Candidates that did respond successfully tended to include a comparison of lumen size and thickness of walls or a comparison of the amount of muscle or elastic fibres in the walls of each.

Most candidates scored well on question 1 (b), with many obtaining marks for including information that frequently spanned several of the marking criteria. Candidates were well aware that fat 'blocks arteries' and often mentioned the coronary arteries. Responses that gained two marks were more likely to add details such as 'heart attack' or 'heart disease' for the second mark whereas candidates that were awarded full marks described how blood flow or oxygen delivery to the heart was reduced. Less able candidates scoring one mark were likely to gain this for stating that a high fat diet could lead to heart attack.

Although the majority of the responses given to question 1 (c) (i) were concise and correct some answers that failed to score only did not include details about both arterial blood pressure *and* heart rate. Other unsuccessful

responses went on to describe how adrenaline 'controlled metabolic rate' or how it affected breathing rate which were totally unrelated to the question asked.

In question 1 (c) (ii), most candidates are aware that adrenaline is carried by blood plasma.

Many candidates understood the role of adrenaline in the body although some did not apply their understanding to the context given in question (c) (iii). For example, responses included details covering the 'fight or flight' response or how adrenaline caused 'pupils to dilate' which improved vision or how adrenaline 'increased breathing rate' rather than explaining how the effects of the hormone benefited the athlete during a long distance run. Consequently, details such as 'more oxygen is breathed in' or that 'blood is diverted from gut' failed to gain credit as they were simply in the wrong context. Most commonly, candidates were aware that adrenaline increased heart rate to increase blood flow to muscles although many failed to state that the increased blood flow (carrying more oxygen) was necessary for *aerobic* respiration to take place more quickly. Candidates failed to gain a mark by simply stating 'respiration'. Similarly, candidates that stated 'energy is produced' or similar failed to obtain the fifth marking point stating that energy is *released*. There were many well written, succinct answers that drew on information gained from previous questions and included further details that reflected a good understanding of the beneficial role of adrenaline in the context of the athlete. Candidates scoring three marks generally covered marking points 1, 2 and 3 in their answers.

Question 2

In question 2 (a) (i), a large number of candidates *described* rather than *explained* the results of the investigation at 40°C and gained only one of the two marks for their response. These were fairly lengthy responses that described in detail the drop in pH across the time period shown in the table without going into further detail to explain this trend. Candidates that did score a second mark most often stated that 40°C was the optimum temperature for the lipase but generally failed to recognise that the production of fatty acids was the cause of the increasing acidity. Few candidates noted the consistency in the pH after 10 minutes – only the most able identified that this was likely to be due to all fat being broken down at this point in the experiment.

Many good attempts to answer question 2 (a) (ii) were seen and most of these used ideas based on the collision theory to gain full marks. The majority of candidates, however, scored one out of the two marks available and this mark was obtained by candidates that tended to base their answer around the rate of reaction, stating that it was slower at 30°C than at the higher temperature. More able candidates recognised that the enzyme had less kinetic energy at 30°C than at 40°C which reduced the rate of reaction although most failed to state that this lowered the chances of collision between the enzyme and its substrate.

For question 2 (a) (iv), litmus paper was an incorrect response commonly seen, either on its own or in addition to a correct answer. The list rule was applied in these cases and any correct mark was cancelled. Other answers that failed to gain a mark included simply 'indicator' or 'pH strips' with the most common correct answer being 'universal indicator'.

In 2 (a) (v), candidates failed to gain marks for stating that bile breaks down fat or that bile digests fats to smaller molecules or fatty acids. Several candidates stated that the action of bile would make it *easier* for lipase to break down the fats and, again, this failed to score a mark as it was expected that students recognised that the reaction would take place faster. A large number of candidates described the alkaline nature of bile, giving this priority over other details that would have given them marks. Overall, the number of candidates that failed to gain any marks for this question was slightly more than the number of candidate gaining 1, 2 or 3 marks suggesting that this particular area of the specification is less well understood.

In terms of question 2 (b), candidates were disadvantaged by their choice of terminology in some cases – 'better' or 'more effective' absorption were not acceptable alternatives to 'faster' absorption and were not credited. However, there were many good answers that covered several of the points in the mark scheme. Most commonly, candidates were aware of the increased surface area of the small intestine and the presence of villi and lacteal which credited most with the three marks allocated to this question.

Question 3

Most candidates scored well in question 3 (a) (i), indicating a good knowledge of base-pairing.

In question 3 (a) (ii), rather than state how a mutation would affect the DNA strand shown in the diagram a significant number of candidates described the possible consequences of a mutation e.g. a different amino acid and/or protein would be made. Many candidates successfully described specific mutations e.g. deletion or substitution whereas other responses were too vague to gain credit e.g. changes the genetic code.

Marks were lost by candidates in question 3 (b) for just describing the phenotypes of each person at each level of the family tree and unfortunately this is what most tended to do. These lengthy responses that stated nothing more than who was affected and who was unaffected failed to score. Many candidates were able to extract simple information from the diagram and use the key given to elucidate that only females were carriers for one mark but it was only the more able candidates who were able to analyse the diagram in more depth to conclude that colour-blindness is a sex-linked disorder or that it was carried on the X chromosome. Very few candidates were able to state that *only* males were affected.

Question 4

Question 4 (a) (i): by far the most common incorrect answer to this simple calculation was 20 500 ($41\ 000 \times 0.5$) where candidates failed to multiply up to one year. Answers of 182.5 were also seen frequently where candidates multiplied the number of days in a year, 365, by 0.5. Other inaccuracies in responses arose from an apparent lack of knowledge of how many days there are in one year, hence multiplications involving 360, 362 and others were seen. Many candidates carried out a division sum, diving 0.5 into 41000 and then multiplying up by 365 days and, again, failed to score.

For question 4 (b), marking points 1 and 3 were covered most often in responses for this item and although many candidates came close to scoring full marks most failed to explain clearly or in insufficient detail why agglutination took place. Hence, important detail was omitted from many responses that limited the majority of answers to two marks. Some students preferred to use vague descriptions that included details on rejection which was very common.

Question 5

In question 5 (a) (i), significantly more candidates scored one mark than those scoring nothing for their response. A very limited range of incorrect answers were seen across students' responses although most stated 'lymphocyte' rather than phagocyte.

Question 5 (a) (ii) was well answered with the vast majority of candidates giving good descriptions of the action of phagocytes. The most common incorrect answer included details on antibody production.

Most responses seen in 5 (a) (iii) omitted key details that lost many candidates marks. Many failed to obtain marks at all, leaving only the very best candidates scoring, most frequently, 2 marks for their answer. Poorly structured answers and the use of incorrect science were seen often and it was evident in many cases that a weak understanding of viral reproduction was the main contributor to the low scores obtained by candidates for this question. Many students referred to virus 'cells' being made or repeated the question by stating that 'viruses reproduce' inside living cells without stating how. Some responses discussed viruses as 'parasites' and taking over the cell without mention of how the replication of viral RNA resulted in the production of viral proteins. Few responses referred to the attachment of the virus to the cell membrane and those that did often failed to mention that the genetic material of the virus was injected into the cell. It was far more common to read of the virus itself entering the cell and its genetic material being referred to as DNA rather than RNA.

There were a large number responses to question 5 (a) (iv) that simply reworded the question. These stated that people with HIV were more susceptible to common infections. These responses gained no credit and neither did the numerous, detailed answers that described how the T-helper cell or the virus were covered with antibodies, or conversely, the antibodies

were covered with viruses, some of which referred to viruses as cells. It was clear that a large number of candidates failed to use the diagram to help them with their answer and relied on recall to construct their response thus providing answers that were often out of context. 'Weakened immune system' came up often and although it was credited other details provided such as viruses 'fight' or 'attack' the pathogens did not draw any further mark. Many candidates failed to recognise that the destruction of T-helper cells meant that other white blood cells were not stimulated and, consequently, phagocytosis and antibody production were suppressed.

At least half of candidates scored one mark in question 5 (a) (vi) for understanding that the CD4 protein would be changed in some way by a mutation. More able students were able to score a second mark by adding further detail with most of these linking the shape change in CD4 to a lack of attachment by the virus. Few candidates mentioned that this would then result in HIV not being able to reproduce.

In question 5 (b), the most common omission in responses to this question was that *lymphocytes* produced antibodies and as a frequent alternative described how the *body* produced antibodies. Some failed to gain marks by stating that the pathogen was 'killed' for the third marking point and there were many responses that referred to the antibodies 'fighting' or 'attacking' the pathogen or antigen. This terminology was deemed unacceptable. Candidates seemed to struggle in describing a faster secondary response with many answers confused and lacking clarity on how this was actually brought about. Less able candidates discussed antibodies turning into memory cells and others stated that antibodies were injected as opposed to weakened pathogens or antigens.

Question 6

In question 6 (a), the vast majority of candidates were able to correctly identify ADH as the hormone involved in osmoregulation.

Only the least able candidates were unable to identify the pituitary gland as the organ responsible for releasing ADH in question 6 (b). The most common incorrect answer here was the adrenal gland.

Question 6 (c) was particularly well answered by most candidates, many of whom scored at least 3 marks for including details that described the role of the hypothalamus, the permeability of the kidney tubules and water reabsorption. Some candidates missed out on the fourth mark by failing to state that ADH was released from the *pituitary gland* although others were more successful and gained this mark for stating that less ADH was produced once the blood became more dilute. There were several responses that discussed how the negative feedback system was involved in blood glucose regulation or included details of other hormones e.g. adrenaline, which were not necessarily incorrect in their scientific detail but that bore no resemblance to the control of water in the body. It was disappointing to read several times that the kidneys absorb more water or similar, implying that some candidates do not understand the difference between absorption and reabsorption. Details of this nature failed to score a mark for this

particular marking point. Responses from few candidates were confused on the role of ADH, sometimes stating that more ADH would be released if the blood was too dilute or vice versa.

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