

Examiners' Report/  
Principal Examiner Feedback

January 2016

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

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Examiners report

Question 1

1ai - Many responses failed to give the full, correct phenotype with the gender of the offspring being the characteristic most often overlooked. Many candidates gave an correct response for the genotypes of offspring although those that failed to score the marks for this gave random genotypes as their answer or interpreted their correct offspring genotypes incorrectly e.g. by stating that  $X^HY$  was an 'affected male' or that  $XhY$  was a 'normal male'. The vast majority of students expressed  $X^HX^h$  as a 'normal' or 'unaffected' female rather than use the terminology given in the specification although this was credited as was  $X^HY$  as a 'normal' or 'unaffected' male. Answers to this question made it clear that candidates ability to link alleles in a genetic diagram to elucidate offspring genotype was sound although interpretation of these genotypes to describe the physical characteristics of the offspring as a phenotype was quite weak. A fairly large number of candidates failed to recognise  $X^hY$  as a male with haemophilia and described this phenotype as a male carrier. Similarly the  $X^HX^h$  genotype was described as a haemophiliac by many students who clearly misunderstood the cause of this genetic disorder despite being given clearly in the stem of the question.

1a ii - The most common correct answer given was 50% although this was also expressed as a fraction and less commonly as a decimal. Some candidates clearly misunderstand how to represent ratios with many responses incorrectly giving 1:2 as their answer rather than 1 in 2. Most candidates however were able to use the information given in the question to arrive at the correct answer.

1a iii - Although it seemed that many students did understand why the male child would not inherit haemophilia from its father the responses were generally poorly expressed and vague e.g 'the father is not a carrier of the allele for haemophilia' or, incorrectly, 'the father does not carry the dominant  $X^H$  allele' or 'the mother carries the faulty allele/gene'. Similarly, candidates stated that the 'mother was a carrier' rather than the recessive allele is carried on the X chromosome or for a maximum of one mark 'the child inherits haemophilia from the X chromosome' without any mention of inheriting the 'non-affected' Y chromosome from the father. Consequently, few two mark responses were seen. A very limited number of candidates stated clearly that the Y chromosome was inherited from the father. Some candidates missed out on mark as a result of a lack of understanding of terminology. For example 'the allele for haemophilia is carried on the X gene' or 'male children inherit the Y gene/allele from their father'.

1b - There is a general lack of understanding by candidates of the outcomes of mitosis and meiosis. Some knowledge was shown, mostly in that meiosis produces 4 cells although many candidates chose option C as their answer where the term 'haploid' caused some confusion.

1ci - Many candidates scored one mark here and the criteria covered in the responses given varied significantly. A good number of students were clear in expressing that DNA codes for proteins although few mentioned that it gives instructions to make proteins. Several identified that DNA contained genes and the few scoring two marks often went on to say that genes code for proteins.

1cii - A large number of candidates were confused by this question and came up with random figures to total 100% without realising that the percentage of adenine, for example, equalled the percentage of thymine in a section of DNA. Consequently many candidates failed to score for their response to this question.

1d - A well answered question overall where most candidates were able to state that ionising radiation mutated DNA. Better responses were well expressed where more able candidates described base changes in the DNA molecule for one mark.

## Question 2

2ai - The food web was interpreted extremely well by the vast majority of candidates who correctly identified either frogs or minnows as a secondary consumer feeding on insect larvae.

2aii - Less able candidates failed to recall correctly the reactants and products of photosynthesis with common mistakes being repeated as in previous years. Incorrect answers include reactants such as nitrogen, glucose and oxygen and products such as energy, sunlight and water.

2aiii - Adding iodine solution was often awarded for one mark although a fair number of candidates gave the incorrect colour change. Brick red was the most commonly quoted incorrect answer where candidate's responses implied confusion with the Benedicts test for reducing sugars. Some candidates failed to mention that it was iodine *solution* that was added to a sample and these responses implied that solid iodine was added for no mark.

2b - Candidates that gave 9.67% as their answer were awarded one mark if the correct working was shown. This was more often than not the case. Many candidates scored full marks for their response with some rounding up to 9.68% and others to 9.7%. Where a response was seen, whether it was correct or incorrect, all working out was shown. This highlighted the main error that students were making: most answers that failed to gain any marks had carried out the incorrect division, dividing 18500 by 1790 rather than the other way round.

2ci - This question was answered well by the majority of candidates who gave bacteria as their response to gain the mark. Those that were unsuccessful tended to randomly pick one of the organisms from the food chain e.g. sheep or alternatively a detritivore such as worms.

2cii - Several responses discussed using sheep faeces as a fuel as a method of reducing energy loss and others suggested that cutting the grass would reduce energy loss. Other candidates suggested that keeping sheep in a cool

environment would prevent energy loss or that controlling temperature would have an impact without actually clarifying and adding detail that suggested keeping them in at a *warmer* temperature. There were many suggestions about using the waste from the sheep as a fertiliser which was not linked to the focus of the question or by feeding them more or giving them a diet with more carbohydrate or protein. Some responses suggested giving the sheep less food. All of these responses failed to gain a mark. Better candidates understood that restricting the movement of sheep or keeping them warm (so energy is not wasted maintaining body temperature) would reduce energy loss and these were awarded as valid suggestions.

### Question 3

3ai - Most candidates scored one mark for their responses although failed to gain the second mark. The majority identified the fluctuations in the number of people in the TB over the 12 year period but neglected to state an increase in the overall trend. Those that scored full marks did discuss both points in their answer but any manipulation of data attempted was generally incorrect as candidates did not extract the correct data from the graph to use in their response. Students that quoted data straight from the graph were often awarded a mark by stating that the number of people with TB increased from 11.2 to 13.9 per 100,000 people but other responses were not credited. For example, those that stated '*around*' 11 per 100 000 people failed to gain a mark as their answer did not reflect accurately or precisely what was shown on the graph.

3aia - A variety of different calculations were expressed, many of which were incorrect. However, most candidates did attempt an answer. Of the answers seen, most showed working out which was pleasing although it is evident that a large number of students were unsure of how to manipulate the data in the graph and in the question to find the number of people infected with TB. Some candidates derived the correct values to work with but then put them into an incorrect calculation, others misread the data shown in the graph although used a correct calculation that included 63 million.

3aiii - For one mark, the majority of candidates understood that cities were overcrowded or had a higher population but most of these candidates failed to give further detail to obtain a second mark. Similarly, many candidates stated that TB was spread by droplets or through air but omitted to mention information related to high population density. Consequently a smaller number of students gained full marks for their response. Marking point 3 was not seen at all in any response. Candidates that failed to score focussed their discussion on pollution of some kind, including that from industry, smoking cigarettes or 'dirty' water as causes of the spread of TB.

3b - Most candidates responded correctly giving 'bacteria' as their response for one mark. Various forms of the bacterium were often quoted e.g. mycobacterium tuberculosis or mycobacterium bovis which were both correct. The most common incorrect answer was 'virus' although other candidates attempted to describe how TB was transmitted e.g. through droplets or smoking rather than state the type of microorganism that causes the disease.

3d - Too many responses referred to injecting a weakened form of the *disease* or inactive form of disease rather than the pathogen or antigens of the pathogen. Some student response implied that vaccinations reduce chances of infection which did not answer the question and failed to gain marks. Better responses included clear details on the action of white blood cells and the formation of memory cells including information that implied a rapid response to reinfection for full marks.

#### **Question 4**

4a - Some very clearly drawn bar charts were seen where most candidates scored full marks. Bar charts that failed to score two marks generally lacked a key, or were drawn with one bar on top of another. Some students drew line graphs, despite the instruction given in the question, which were confused and lacked the clarity needed to score any marks.

4b - Few candidates failed to score here and answers were generally well written. Responses gave clear details that reflected sound understanding of why blood flow is diverted to skeletal muscles during exercise including details about oxygen delivery and aerobic respiration. Candidates that failed to score full marks tended to be too vague in explanations that required clarity or that failed to manipulate data correctly to give incorrect figures comparing blood flow at rest and during exercise.

4c - Many students incorrectly linked an increase in blood flow to the skin to greater sweat production or that an increase in blood flow caused sweat to be produced. Some stated that the skin needed more energy during exercise (due to more sweating) so a greater blood flow would deliver more oxygen for aerobic respiration to take place. The term vasodilation was used loosely on many occasions and no award was given for this term being used in the wrong context. For example, some candidates discussed how sweating caused vasodilation or that the 'skin vasodilates' or that 'vasodilation occurs to maintain water balance in the body'. Many responses were expressed poorly or information was given in the wrong context in other ways: 'blood capillaries move to the surface of the skin', 'blood carries oxygen to the skin to cool it down', 'blood flows at higher pressure in the skin during exercise and lower pressure at rest', 'heat is evaporated from the skin' are examples of a few that were seen. A large number of responses focussed on sweat production itself with little or no detail on how this linked to an increase in blood flow to the skin's surface and cooling of the body. Candidates that did score full marks often recognised the rise in body temperature during exercise, the need to lose heat and that vasodilation and/or greater blood flow occurred at the skin's surface.

## Question 5

5a - A large number of responses focussed on osmosis and how the movement of water would affect the concentration of the sugar solution or the enzyme/starch solution inside the visking tubing. Although marking points such as partially permeable membrane were mentioned these tended to be in the wrong context, discussing how water would move from a high to a low concentration. Some students described concentrations of 'water' e.g. water moves from a high concentration of water to a lower concentration of water' in their attempt to explain the results of the investigation. The most common score for responses was three out of the four marks where candidates recognised that the enzyme broke down the starch to sugar and that the sugar then moved out of the visking tubing into the water. Few stated that the sugar 'diffused' through the membrane although some went on to gain a mark by mentioning that the sugar moved from a high to low concentration. Very few responses recognised the enzyme as amylase – only the most able candidates scored this mark.

5b - Few candidates described how an increase in temperature would increase the rate of reaction and a fair number failed to recognise that such a high temperature would denature the enzyme. Many candidates mentioned the optimum temperature of the enzyme and how denaturing affected the active site for three marks. Several also went on to say how this would affect the 'fit' of the substrate to the enzyme. Some answers were too vague to award any marks. These were along the lines of 'the results would be different' or 'a change in temperature would affect the reaction'. There was very little use of the term 'complementary' or substrate 'binding'. Students preferred to use phrases such as the substrate won't 'fit' the active site or that the shapes (of the enzyme/substrate) no longer 'match'. A few candidates mentioned the starch denaturing rather than the enzyme or that the enzyme was 'killed' at higher temperatures.

5c - Some students discussed how changing the size of the visking tubing would affect the rate of osmosis which was not the focus of the question. This was similar to a large number of responses that failed to mention how changing the concentration of the starch solution and visking tubing affected the concentration of the sugar solution on the outside of the visking tubing. Other responses implied confusion and discussed how the concentration of starch affected the reaction: many candidates described how an increase in the volume of starch solution would decrease the rate of reaction due to a greater quantity of starch present to be broken down by the enzyme. Few students linked an increase in the size of the visking tubing to a faster diffusion rate. In fact a vast majority of students stated the converse. Similarly, it was common to see responses that linked an increase in the size of the visking tubing to a decrease in the rate of reaction which was incorrect. Many responses were too vague to award e.g. changing the concentration of starch/size of visking tubing would change the reaction or would increase or decrease the rate of reaction. These lacked the depth of information necessary to gain any marks.

5d - A variety of incorrect responses were seen from candidates who were clearly unsure of the site of production of amylase. The liver was the most

frequently given as an incorrect response although other candidates gave mouth, small intestine, stomach, saliva and even bladder as responses that were not awarded. A few candidates gave a list that included the correct answer as well as incorrect answers and in these cases the list rule was applied. A fair number of students gave pancrease rather than pancreas in their response and awarding was deemed lenient in these cases. It should be noted that correct spelling of scientific terminology can, in certain circumstances, determine whether a response is credited or not and it is, therefore, important that candidates do not confuse the spelling of scientific terms.

### **Question 6**

6 - Some excellent answers were seen in response for this question with many candidates showing a sound understanding of the role of hormones in the menstrual cycle. It was clear that some candidates did not read the question carefully and responses deviated from the details expected. For example, some candidates discussed the role of progesterone during pregnancy and some responses were implied confusion about where hormones are secreted from e.g. oestrogen from pituitary and thus failed to gain marks for this. Some candidates stated that FSH 'makes' egg cells and others included more detail than necessary for example by discussing hormonal control in the development of Graafian follicle. Less able candidates that were unable to score were often able to state the names of hormones involved in the menstrual cycle but were unsuccessful in their attempt to describe their roles e.g. progesterone controls the menstrual cycle.

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