



General Certificate of Secondary Education

**Additional Science 4463 /
Biology 4411**

BLY2H Unit Biology 2

Report on the Examination

2011 examination – January series

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Additional Science / Biology Higher Tier BLY2H

General

The examiners were particularly concerned at the common misconceptions, poor use of terminology and frequent lack of apparent knowledge of an appreciable proportion of candidates. This was particularly evident in questions 4(a) (the genetic control of gender), 7(b) (osmosis) and most parts of question 8 (temperature regulation); all of which are areas of the specification that the examiners might have hoped would provide relatively high scores. As a result many candidates scored fewer overall marks than had been expected at this level. Whilst there is willingness on the part of examiners to award credit wherever possible, a significant proportion of candidates made this difficult by using poor expression and explanation, which often failed to answer the question. There was though a marked increase in the number of candidates using appropriate technical language that is not within the specification. Thus terms such as 'heterozygous' (question 6) and 'water potential' (question 7) were by no means uncommon, along with the almost universal 'denatured' (question 5), and certainly helped candidates to express their ideas more succinctly.

Candidates should be encouraged to read the information provided in the stem of each question, with great care, as this sets the context on which the questions are based. Some candidates choose to highlight or underline what they consider to be key words or information in the question and this should be encouraged as it helps candidates to focus more effectively on the information and then link it to the questions. A number of examiners suggested that candidates appeared to be answering different questions to those set, for example in question 2(b) (pyramids of biomass) and 4(c) (evaluation of embryo screening). As usual, candidates are reminded to pay specific attention to the command words in questions ('explain', 'describe', 'suggest' and particularly 'evaluate'). Additionally candidates should be reminded that the use of comparative terms in questions is an indication that comparative terminology is required in an answer, e.g. questions 1(b)(ii) and 8(a).

However there are some improvements to the way the vast majority of candidates work. Fewer examiners were concerned about the quality of written English or the quality of writing and there were very few instances where candidates continued responses outside the 'box' on the page. Although the space provided in the paper is considered to be more than enough for candidates to compose a good quality and complete answer, some candidates still find the need to look for additional space, perhaps because they change their mind, after writing an original answer or, unnecessarily, rewrite much of the information provided in the question. In these cases candidates should first of all use the space *just* below the printed lines for that question, on the paper, then other 'white space' on the page, and as a last resort, additional sheets. However, in the last two of these cases candidates should be reminded to indicate *clearly* that their answer is continued elsewhere, e.g. by an arrow or 'continued' written at the end of the original answer lines. Those candidates who fail to make such an indication when they use other parts of the page risk having their efforts go left unmarked as only response lines/spaces are scanned for marking.

Candidates should be advised not to cross out a response unless they replace it with another answer. Crossed out responses that are not replaced are marked anyway, however crossing out often obliterates key components of what might have been a creditworthy answer. In addition a response that is only partly crossed out, even to the extent of leaving just one word not crossed out, will only have the 'uncrossed-out' portion marked.

Question 1 (Standard demand)

On the whole, this question was well answered by the majority of candidates. Most candidates appeared to be familiar with the experimental methodology, if not this independent variable, and were able to relate their knowledge and understanding to the information provided.

- (a) (i) Inevitably, in this part there were those candidates who were unsure as to what an independent variable is and arrived, collectively, at any number of suggestions, ranging from 'pondweed' to 'bubble number' and 'time'.
- (a) (ii) 'Time' was also not an uncommon, but incorrect, response in this part, where a wide range of answers was accepted. The most common referring to the 'amount' of 'water', 'pondweed' or 'light'. The loose terminology, 'amount' was accepted here as candidates' intentions were clear, however candidates should be encouraged to use more appropriate terminology such as 'mass', 'length', 'intensity' or 'volume', as there will inevitably be a time when 'amount' is ambiguous and therefore not acceptable. Those candidates who only got as far as 'pondweed' were not awarded the mark here, as it was unclear whether they were referring to 'the same piece', 'the same type' or the 'same mass/amount' or perhaps to using pondweed, rather than a different plant. References to 'carbon dioxide' and 'ambient light' were relatively uncommon. It might be noted that 'temperature' alone was sufficient, however those who qualified this, needed to do so correctly, to gain the mark.
- (a) (iii) It was perhaps fortunate for many candidates that the examiners decided to ignore answers regarding 'precision', 'accuracy' and 'fair' as these terms, particularly the first two, turned up very frequently in responses that also included acceptable suggestions. References to 'reliability', 'averaging' and 'spotting changes or anomalies' were common, although those who chose to go down the route of 'losing count' sometimes suggested that it would be easier to lose count if bubbles were counted for single minutes. Here it was vital that candidates read the phrasing in the question, in order to compose their answer correctly.
- (b) (i) The vast majority of candidates selected 'green' for (b)(i) and went on to explain why this would be the most appropriate colour
- (b) (ii) Reference to there being 'fewest bubbles', indicating 'least photosynthesis', were common and gained two marks. The development of this idea, that 'less glucose' would be produced, as a result, was rare. Those candidates who only referred to less bubbles resulting in 'less growth' were not awarded the second mark, as ideas regarding less growth were given in the stem of the question. A minority of candidates confused photosynthesis with respiration and suggested that the bubbles 'contained carbon dioxide' which lost the first mark. A few candidates failed to use the information in the question and table properly, suggesting that a particular light colour would 'reflect nicely off the fish' or 'help the fish to see well'!

Question 2 (Standard demand)

- (a) (i) Nearly all candidates found part (a)(i) straightforward and gained both marks. A few made errors in the calculation but, having shown their working, usually scored the one mark for '300 x 20'. Most completed the pyramid correctly,

- (a) (ii) in this part there were occasional, and perhaps predictable, errors. Some tried to extend the width of the pyramid to 6000 either side of the mid-line. These candidates might have realised that this was wrong as it would be impossible to mark effectively. Others occasionally drew a bar of 3000, believing that the calculated figure needed halving, even showing this in their calculation, above. Drawing was required to be accurate in terms of width; candidates who were casual in their answering here, leaving doubt as to where the bar extended from or to, missed out on the first mark. Those candidates who arrived at the wrong value in (a)(i) could gain full credit in (a)(ii) for either a bar indicating 6000 or a bar matching their calculated figure. Only a very few candidates drew the bar above the hedgehogs and thus failed to get the second mark.
- b) This part proved to be more demanding than was expected and demonstrated the rather loose understanding that many candidates have when it comes to biomass and pyramids. Few managed to obtain maximum marks. The most common failing was to try to explain the mathematical concept as to why 6000 is larger than 1200, referring to the larger number but smaller mass of slugs compared to the smaller number but larger mass of hedgehogs and the fact that the one outweighs the other in terms of biomass. This gained no credit. Many candidates focussed their responses entirely on slugs, explaining how slugs lost mass once they had consumed the lettuce. Relatively few candidates got round to the real issue as to how hedgehog biomass fails to become the same as that of the slug population. Losses through 'faeces', 'excretion' and 'respiration' by the slugs were commonly stated but not credited, as it is these same losses *from the hedgehogs* that causes the decrease in population biomass. Those candidates, who wrote in general terms, describing losses, but not assigning them to either slugs or hedgehogs, were awarded marks appropriately. Some candidates were more inventive implying that, for example, the hedgehogs were more likely to be killed by foxes or by cars or that more slugs survived as they were better camouflaged or better fed by the plentiful lettuces. Others thought that the hedgehog population would be limited as there was only one of them, so it could not reproduce! Many candidates were obviously aware of mark schemes from recent exam papers when questions had been set on *energy* losses in food chains. It was, therefore, common to see references to these rather than to reasons for biomass differences. Frequent mention of 'movement' or 'heat losses', consequently, gained no credit. A few answers reflected confusion between undigested material and excreta. Loss of carbon dioxide (as a result of respiration by the hedgehogs) was rarely commented on by candidates.

Question 3 (*High demand*)

- a) The great majority of candidates were familiar with the 'pancreas' as the organ that monitors blood glucose concentration. Incorrect suggestions included 'kidney', 'brain' and, oddly from one candidate, 'leaf'. Most could also go on to read the relevant information from the chart,
- (b) Although examiners were surprised at the lack of care exhibited by some candidates, as '4' to '7' was not an infrequent wrong answer. Almost all candidates did use the correct part of the chart.
- c) The most common error in part (c) was to begin by reading the graph/key incorrectly, and taking '10' rather than '7' as the best concentration two hours after meals. Inevitably this resulted in the candidate arriving at the incorrect final figure, '1.5', rather than '3'. A third mark was available for identifying that there needed to be an 'increase', however

described' in the insulin dose. It was not uncommon for candidates to omit this from the answer line, although it was credited if shown in the working space. In order to secure the second mark candidates also needed to use the correct unit in their answer, 'units', some ignoring any reference to a unit of any kind whereas others suggested 'mmol per dm³' or even 'kg'! The examiners were shocked at the significant number of candidates who could not complete the simple calculations they had set down in their working. Most notably '13 – 7', which was not uncommonly shown to '= 5', or even '= 4'. Inevitably two marks were thrown away for such weak mathematical skills. Despite these often careless errors, many candidates managed to secure all three marks in this part.

Question 4 (*High demand*)

- a) Candidates found this part difficult and responses were frequently disappointing. Various errors and incomplete arguments were made. A small percentage of candidates seemed to have been influenced by the context of 'women with breast cancer' and, consequently, followed the incorrect 'disease' route. They discussed the chances of breast cancer alleles being present in the embryos instead of the female XX/male XY pairing. Many others believed that a slightly extended reiteration of the question was all that was required. Answers such as 'there is always a 50% chance of having a female baby and a 50% chance of having a male baby', 'taking a random sample of embryos they have to assume that half will be female as there are only two sexes' or 'it would cause a sexual imbalance if not' were all too commonly seen and gained no credit. Other incorrect answers which, nevertheless, attempted to explain why HALF were female included 'an equal number of eggs and sperm cells were used' and 'half the genes/chromosomes come from the mother and half from the father'. Some had other surprising misconceptions such as 'X is dominant and Y is recessive' or 'the egg is bigger than the sperm and therefore dominates'. Candidates occasionally used the X and Y symbols the wrong way round, referring to females having the YY or XY combination of chromosomes. Other mistakes included references to X and Y alleles/genes and, commonly, to eggs containing two X chromosomes. Candidates should be reminded that by saying there is a '50/50 chance' of something occurring they are actually inferring 100% likelihood of an event. Answers such as 'sperm cells have a 50/50 chance of containing an X chromosome', therefore, gained no marks. As is often the case in questions of this nature, a correct diagram which had been clearly annotated was acceptable and candidates who gained full marks often did so in this way.
- c) Candidates showed their lack of expertise in tackling evaluation questions of this sort and, consequently, it was unusual to see answers that gained all four available marks. The first point that candidates should always be very aware of is the precise context their responses need to be matched against. In this instance, for example, the stem of the question referred to 'the female embryo did not have the allele'. It was, therefore, not enough to simply reiterate this as an advantage of the procedure. Candidates were expected to take it a step further in their thinking and say that the girl would then be 'less likely to get breast cancer'. The question then went on to ask for advantages and disadvantages of 'the whole procedure'. In saying this it invited a discussion of points that related to a mother wanting to have a daughter free of the breast cancer allele, not necessarily to embryo screening in general and certainly not to different procedures such as 'genetic engineering', 'stem cell research', 'transplant surgery' etc. Answers which reflected questions (and mark schemes!) of previous years without addressing this particular procedure, therefore, often failed to gain credit. Candidates who said that 'it allows parents to decide whether or not to bring a child into the world with a disease', 'it allows parents to prepare emotionally for the birth of a baby with a disease' or 'parents

can choose to have an abortion' were not awarded marks as the specific example in the question indicated that none of these would be the case.

The majority of candidates failed to gain credit, however, because they gave answers that were far too vague. Phrases like 'it's unnatural', 'it's tampering with nature', and 'the baby will be healthy' (often stating or implying that there would be no 'undesirable genes') and 'it's not right to choose your baby' were clearly insufficient. The advantage based on cost had to be qualified with the implication that the procedure was less expensive than having to subsequently treat a breast cancer sufferer; the disadvantage based on ethical/moral reasoning had to be qualified by it being wrong to reject or discard embryos. Candidates should develop their answers by giving clear explanations of their ideas as to why something is of benefit or not. Responses stating an advantage as 'having a baby this way will not need a man' (!) or giving a disadvantage as 'the child will not know her father' or 'the sperm may not come from the right man' clearly gained no marks. When writing a conclusion to the overall evaluation it is necessary to come down on one side of the fence or the other. Statements that simply said 'it has both positive and negative effects' or 'it is good because a baby is born without the disease but it is bad because embryos are killed' did not gain credit. It is also necessary to restate both at least one advantage and one disadvantage in the conclusion – the decision has to be 'argued' in this sense. No award was given for this final mark if a student only wrote, for example, 'I think that overall this is a good idea because the baby will be less likely to get breast cancer'.

Question 5 (High demand)

Candidates appeared to have coped quite well with the novel situation presented in part (b) of this question.

- a) Part (a), though, required clear knowledge of the details regarding enzyme action provided in the specification. The great majority of candidates described enzyme destruction, with most of these quoting 'denaturation', although this term is not a specification requirement. Relatively few, though explained that this would result in enzyme and (chemicals within the) stain being unable to 'fit' together. Over the past few examination sessions examiners have been pleased to report a decline in the use of the term 'killed' or 'died' in reference to enzymes; however an appreciable number of examiners reported an increase in the use of such terms this session.
- b) (i) Candidates were able to apply their understanding effectively and frequently arrived at two or all three of the marking points. Occasionally poor explanations made the examiners unsure whether the enzymes were in the washing powder or still in the bacteria; those conveying the latter idea were not awarded at least one of the marks.
- b) (ii) The majority of candidates made the expected connection between the use of a higher temperature and the potential need to use additional energy with its consequent effect on suitably qualified emissions from power stations. Weaker candidates, though, often misunderstood vital components of the information, suggesting possible 'damage to the hot springs' caused by 'removing bacteria from them' or the polluting effects of transport as a result of 'carrying bacteria a long way'.

Question 6 (High demand)

- a) In previous sessions candidates have tended to use the term ‘carrier’ somewhat loosely, when describing inheritance patterns. However in the majority of cases candidates did better than expected and overall the question was answered well. Most candidates seemed sure of their ground when it came to saying that cystic fibrosis is caused by a recessive allele although a few answered only in terms of Huntington’s disease and the very weakest seemed to believe that Huntington’s disease and cystic fibrosis are two alleles of the same gene, thus you could ‘have one but not the other’. Some, however, used poor descriptions such as ‘less dominant’, ‘weaker’, ‘dormant’ or ‘hidden in the genes’. No credit was gained in these instances. Candidates seemed less certain of how to best explain the nature of a carrier. Vague statements such as ‘you can be a carrier if a parent had the disease’ or ‘you don’t have the disease but can pass it on’ were not sufficient. The suggestion that a genetic diagram could be used in this answer, however, helped many to gain the mark here. It must be stressed, though, that such diagrams are only of use when they are clearly annotated. Candidates who circled and labelled the carriers in a diagram easily picked up the second point. It is also important that the symbols used in such cases are unambiguous. Candidates sometimes failed to gain credit when their choice of letter made it difficult to distinguish upper case from lower case. Candidates do need to be more careful in drawing genetic diagrams, as examiners reported a number of cases where offspring in a Punnett square failed to match the parental genotypes. Fortunately, the examiners were not looking for this link, in this question and errors of this nature were overlooked.
- b) This part was again well answered. The vast majority of candidates knew that Huntington’s disease is caused by a dominant allele or needs only one such allele to be present. A few answers simply reiterated the question wording, ‘because it can be passed down by only one parent’, and failed to gain credit. A few had the misconception that Huntington’s disease is associated with males only. Some candidates used poor descriptions for dominant such as ‘stronger’, ‘more positive’ or ‘it overpowers the other genes’ and were not awarded the mark.

Question 7 (High demand)

- a) Candidates were expected to identify two differences between the cell in the sugar solution and that in distilled water. This ought to have proved to be quite straightforward as there is a clear reduction in size of the vacuole along with the cell membrane having been ‘pulled away from’ the cell wall. However, some candidates misunderstood the intention of the question and attempted to *explain* the differences, rather than *describe* them. Others had difficulty remembering the names of cell components, thus ‘chlorophyll’ was by no means uncommon in responses, along with the occasional ‘mitochondria’ and ‘ribosomes’; ‘the clear bit in the middle’ was also seen all too often. The examiners were also willing to accept the idea that ‘there is less cytoplasm’, although this may be debatable. Furthermore, descriptions in terms of the cell in distilled water (rather than sugar solution) were accepted, provided the reference to this cell was absolutely clear. When it came to describing the plasmolysed nature of the cell, a considerable minority suggested, incorrectly, that the cytoplasm had ‘pulled away from the cell membrane’. The examiners only awarded marks for correct descriptions, using the correct terminology, so although many clearly recognised these differences they were unable to gain both marks due to poor expression.
- b) This part required an explanation and although some did this well, referring to the loss of water due to osmosis and the difference in concentration between the solution and the

cell 'interior', many showed considerable confusion. One issue was that candidates failed to refer to the context of the question and merely quoted their well-learned definition of osmosis; in these cases, no marks were awarded. Another problem arose from the difficulty candidates have in describing differences in concentrations; many referred to 'concentration of water molecules' and although this is not the conventional way in which solution concentrations are described, this was accepted, if clear. However there were all too many candidates who appeared unsure as to what concentration they were referring. In such cases, examiners will always assume that candidates are referring to concentration in terms of solute concentration. Inevitably, there were those candidates who appeared to have little idea that osmosis was responsible for the differences, or had such a poor understanding of osmosis that they suggested 'osmosis causes sugar to pass into the cell'. At this level, candidates are expected to have not only a good knowledge of processes such as osmosis, but also to be able to apply their understanding to the situation provided in the question.

Question 8 (*High demand*)

- a) On the whole, this question was answered poorly. The context given here states that 'the woman's rate of sweating increases' in the sauna. This should have implied two things to the candidates. Firstly, that she was not beginning to release sweat all of a sudden but that she was simply releasing more than before. Secondly, and as a result of the first implication, that any answer should be using comparative words to explain this increase. Many candidates understood that sweating leads to water being evaporated from the skin which, in turn, leads to cooling. Without the use of 'more' (or implied), however, in relation to either this evaporation or to cooling they were only able to access one mark. Some had completely the wrong idea here and made comments such as 'sweat is released to give a cooler layer of water on the skin', 'sweat covers up the pores to prevent dehydration', 'the body is trying to re-hydrate itself by sweating' or 'heat is evaporated'. Other answers were too vague such as 'she sweats because she needs to cool down' or 'due to homeostasis, she's trying to lose heat'. Several candidates confused 'perspiration' and 'respiration'. Quite a few pursued another incorrect line by linking sweating directly with vasodilation by saying, for example, 'sweating causes blood vessels to swell' or 'blood is forced closer to the skin and this leads to an increase in sweating'. Correct references to the role of the thermoregulatory centre were quite often seen and credited. Some candidates incorrectly used the term 'thermoregulatory gland', however, and failed to pick up the mark.
- b) As was shown in the June 2010 examination and referred to in detail, in the report, candidates find it very hard to discuss changes in blood circulation linked to temperature control. Several misunderstandings were evident. The first and quite common one was for a candidate to believe that 'blood circulates faster to increase heat loss'. Others included ideas such as 'blood moves nearer the surface to get away from the high temperature core' and 'blood becomes hotter making her look redder in the face'. Quite a few students picked up the 'dilation' mark. Some failed to gain credit for this, however, because they then went on to imply blood vessels had moved nearer the skin surface in the process or even, in a few cases, that dilation was synonymous with 'narrowing'. Although 'widen' was quite acceptable as an alternative to 'dilate', the word 'expand' was not considered enough for this mark. The use of 'blood circulation' in the question may have led students to falsely think they could answer by referring to changes in 'blood vessels' without any qualification of type. Mention of blood vessels in this way gained no credit. However, if candidates described events in 'blood vessels supplying the (skin) capillaries', the mark was awarded. 'Arteries' and 'arterioles' were acceptable here but 'capillaries' and 'veins' were not. A large proportion of candidates referred to 'capillaries

dilating' and were, therefore, only awarded the 'dilation' mark. Some candidates confused 'blood cells' and 'blood vessels' in their answers. They may have made the error in haste but a proportion did seem genuinely muddled over this point.

- c) (i) Although many candidates answered this correctly a variety of either incomplete or incorrect responses were also seen. These included 'the thermoregulatory centre' and 'a fall in core body temperature', neither of which is a 'process' as asked for in the question. Other candidates talked about the ultimate 'effect' of shivering as 'warming the body up' – again, not a 'process'. The correct term 'contraction' was required so mention of 'movement / twitching / shaking' failed to gain credit. Some candidates seemed to be confused with events happening in arterioles and gave 'constriction' instead.
- c) (ii) In order to pick up the second mark here for 'releases heat' it was essential that the candidate referred to 'respiration' occurring. Many did but several gave other reasons and, therefore, gained no credit at all. The most common incorrect ideas linked the warming up with other events such as 'faster/increased blood flow' or 'goose bumps trapping warm air'. Convolved responses which implied a sequence of - muscles work harder so need more oxygen which has to be carried by more blood which in turn increases the rate of blood flow and, therefore, temperature – were sometimes seen. A surprising number of candidates left this question unanswered, perhaps because of lack of time or maybe through the inclination to fold the paper during the exam and forgetting to unfold it.

Mark Ranges and Award of Grades

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