Version 2.0 22/08/2012

General Certificate of Secondary Education

Additional Science 4463 / Biology 4411

BLY2H Unit Biology 2

Report on the Examination

2012 examination – June series

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Set and published by the Assessment and Qualifications Alliance.

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Registered address: AQA, Devas Street, Manchester M15 6EX

Additional Science / Biology
Higher Tier BLY2H

General

The significant minority of students who are entered for the Higher Tier paper when they would clearly have been better served by taking the Foundation Tier paper remains of concern to examiners. This issue has been referred to repeatedly over the life of this specification with no obvious impact on the problem. However this does not deter the examiners from making the same plea to schools that they should take the utmost care in making realistic entries for students. There appears to be a mistaken but widely held belief that 'it is easier to get a grade C on a Higher Tier paper than on a Foundation tier paper'. Struggling throughout an examination will undoubtedly leave a lasting impression on students and may well affect their confidence in other examinations in the series.

Good examination technique is an important tool for students, and this alone can have a vital effect on performance. The two most essential parts of this technique are the students' ability to organise their time effectively and to answer the questions asked. Aware of students' propensity to write everything they know on any subject, wherever possible, often extending responses well beyond the space provided, onto additional sheets and into spare 'white space' around the paper, AQA has slightly increased the number of answer lines printed. This appears to have made little difference to students. This is not the case in any respects, students should be aware that a complete answer will fit into much less than the space provided, even with the biggest of writing. However, where students do need to go beyond the printed lines (perhaps having changed their mind about the first answer given) it is absolutely essential that they indicate that more has been written elsewhere. This was of particular issue in question 5(a) where many students continued answers either onto page 9 of the paper or onto additional sheets. There were probably many cases where students gave no indication of continuation onto page 9 and answers there will not have been marked as, in the first instance, examiners see *only* the printed lines in scanned papers marked on-line. As an absolute minimum, students should draw an arrow or line to the continuation, or better, spend a few seconds writing the words 'continued on the next page'. Answers on additional sheets will always be marked, so for students' security this is where continuations should be written. Examiners were further frustrated by the considerable number of students who continued their answers, particularly to this question, beyond the frame / box on the paper, often into several lines at the bottom of the page. Students should be aware that these answers *cannot* be read by the examiners and so may not gain any marks. Furthermore, the extension of answers to questions with a relatively high mark tariff into at least an extra half page will inevitably reduce students' time for answering the rest of the paper and they would be better served by taking a few minutes to plan their answers more effectively and so be more sure of completing the paper. There was some evidence of students not having time to complete the paper but in almost all circumstances these students had continued answers to earlier questions onto at least an extra ten lines.

Students' understanding of command words always creates difficulties and costs students many potential marks. 'Explain' and 'describe' are the two most commonly confused commands. Unfortunately they have such different meanings that confusion of the two can cost students a considerable number of marks throughout the paper.

Question 1 *(Standard Demand)*

(a) This should have been a fairly straightforward question at the start of the paper. It was expected that most students would be familiar with the experimental technique in the question and will probably have conducted similar investigations themselves. Although they got off to a secure start, giving 'photosynthesis' in this part, examiners continue to be surprised at the number of students who believe that respiration in plants is different from that in other organisms, and suggested 'respiration'. Further evidence for this misconception was seen in question 7.

(b) (i) Some of the control variables were described to students in the information and the diagram, thus answers to this part which only repeated these were not accepted. The most common answers that were ignored by examiners, was 'time', there being two references to 'one minute' in the information and results table. Those students who were familiar with limiting factors for photosynthesis usually suggested at least two of 'light intensity', 'temperature' and 'carbon dioxide (concentration)', often along with 'mass' or 'length' of the pondweed or 'volume of the water'. Students should be encouraged to use terms such as 'mass' and 'volume' rather than 'amount' although the latter was acceptable here. The mark scheme shows other acceptable answers but does not include 'size of the tubes' as the diagram shows that this was already controlled.

(b) (ii) A wide range of acceptable responses was accepted, the most commonly given referring to 'aesthetics' in a wide variety of ways or to the rate of oxygenation. Those students who suggested 'cost' were not awarded the mark as this was excluded by the information in the question stem. As students are not expected to know the growth pattern of pondweed, answers such as 'the size the pondweed grows to' were allowed. However, responses such as 'the size of the pond' without linking this to maximum size of the pondweed were not awarded the mark.

(c) This question was answered correctly by most students, although weaker students gave a wide variety of suggestions, such as 'nitrate', along with several that were neither minerals nor ions.

Question 2 *(Standard Demand)*

(a) (i) Most students gave the expected answer 'insulin' in part (a)(i). A few offered 'glucagon', which was of course accepted, however poor spelling of this term, with hybrids of 'glucose', 'glucagon' and 'glycogen' often left the examiners unsure what was meant and these were not credited.

(a) (ii) Most students correctly named 'pancreas' with only occasional confusion with 'liver', most commonly from students who had given 'glucagon' in the previous part.

(b) (i) Students sometimes made simple errors in reading the scale or gave the value for person A here. A small tolerance was allowed to take account of the thickness of the graph line, however almost all correct answers were '11' or '11.0'. No account was taken of any working shown although it was noticed that some students who had read the correct values from the graph had been unable to subtract 88 from 99 correctly.

(b) (ii) The examiners were looking for any two of four possible differences in the patterns of changes in blood sugar concentration between the two people. Most students achieved this, referring commonly to the 'high concentration' along with one of the other three alternatives. Weaker responses often only gave values, 'the value for A is 115 at the start' without any indication as to whether this is high or low. Although a comparison with person B was not required, some indication of the extent of the irregularity was required eg 'high', 'large', 'fast' or 'low'. Weaker responses often lacked clarity. For example 'it takes a while to get back to normal', 'a while' does not indicate an extent, and is also true of someone without diabetes.

(b) (iii) There were many good answers to this question, which asked for a reason for the decrease in blood glucose in a non-diabetic person. The majority concentrated on 'storage (as glycogen) in the liver', the presence or release of 'insulin' and 'exercise'. 'Respiration', however, was rarely mentioned as such. As previously, there were several hybridised spellings of glycogen and glucagon which could not be credited

and with weaker students there was poor biological knowledge, including suggestions such as 'glucose is digested'.

Question 3 *(Standard / High Demand)*

(a) As expected at this level, most students showed a sound understanding of plant and animal cell structure.

(a) (i) There were some inevitable misunderstandings, notably that 'animal cells do not contain cytoplasm' or 'plant cells do not have cell walls'.

(a) (ii) Most students correctly identified the presence of a flagellum or the lack of a cell wall as being indicative of an animal cell, the most common errors including reference to the shape of the cell or the position of the nucleus.

(b) Those students who recognised that this question was about osmosis often collected at least two of the marks. Those who did not speculated wildly about the possible effects of salt on the cell, including 'dehydration of the cell', that it would 'destroy the cell membrane' or 'cause enzymes to denature'. Those students who had a sound understanding of osmosis generally scored all three marks, although those with a more tenuous understanding made inevitable errors. These errors often included confusion between solute and solvent concentrations. Students have difficulty expressing their ideas about concentration consistently, thus responses often switched between 'concentration' (which examiners take to mean '…of solute') and 'water concentration'. Unravelling these confused explanations often took considerable time and despite examiners' best efforts, some of these descriptions were impossible to untangle. Students are advised to refer only to concentration in one way and to maintain this throughout their answers. Those students who referred to 'water potential' almost always gave clear and concise explanations. A small, but significant, number of students, having correctly described 'osmosis', and the loss of water from the cell, then lost both these marks by also referring to the movement of salt into the cell. The use of terms such as 'flaccid', 'turgid' and 'plasmolysed' were not uncommon, and although these were inappropriate in this situation, they rarely had an impact on the marks awarded.

Question 4 *(High Demand)*

(a) The majority of students were able to identify the two 'other' enzymes produced by the pancreas. Most common errors included naming both 'amylase' and 'carbohydrase' or including 'lipase' as one of their suggestions, although this had been clearly eliminated from the possible responses by the information in the stem of the question. An example of poor examination technique; where students had not taken in all the information supplied in the question. Further errors included the naming of 'pepsin', produced in the stomach, although some correctly named 'trypsin' as an example of a protease.

(b) Students often lost focus on what was going on in the intestine and the capsule, suggesting that the lipase *within* the capsule would not break down the lipid coating until the correct pH and temperature were provided in the small intestine. There was a surprising number of students who suggested that 'lipase does not break down lipids, only fats', which inevitably scored no marks. Good students realised that the lipase is not released in the body until food reaches the small intestine, although it was accepted that this could be produced either in the intestine itself or from the pancreas, as the pancreas was only 'damaged', not destroyed.

(c) A wide variety of speculative suggestions were given in this part. These included, again, references to incorrect temperature and pH, although a good proportion of students realised that, being dry, the enzymes would be inactive. A few good students extended their explanations into the need for enzymes to be in solution to allow reaction with the substrate and formation of an enzyme-substrate complex or referred to the active site of the lipase.

Question 5 *(Standard / High Demand)*

(a) A considerable proportion of students failed to note the instructions in the question, 'evaluate' and 'compare'. Thus much of the available space was used up in simply rewriting the information in the passage. Students should be reminded that there are no marks available for answers such as this and that some additional information, explanation or analysis is required. The instruction to 'compare' should have been sufficient to trigger this. As mentioned in the introduction to this report, many students wrote far more than should have been necessary to gain the first three marking points, but in fact scored none of them, as the answers contained no comparisons between the two types of farm. Examiners were also surprised at the large percentage of students who appeared to have little concept of volume or area. There appeared to be a widely held belief that on 'super farms' *each cow* would be producing 250 000 litres of milk each day or that the total daily output of all the cows on a traditional farm would be only 20 litres. Although students recognised from this, that the super farm would have a greater productivity, no mark was available unless a clear comparison had been made in terms of 'per cow'. Some tackled this calculation in a different, but acceptable, way by calculating the output of 8 000 cows farmed in a traditional manner, so that the comparison could be made. The second though less frequent, misconception was that $6m^2$ is a 'large area for each cow' or was 'far more than cows would get on a traditional farm'. It is disappointing that so many students showed such poor understanding of basic physical dimensions. Many students realised that being kept in sheds would mean that cows on the super farm would use less energy for movement or keeping themselves warm and would be 'more energy efficient' than those in a field, although some believed that keeping cattle indoors would be a disadvantage in that fossil fuels would need to be burned to provide heating to keep the sheds warm. Students often referred to the different use of waste from the cattle in the two types of farm. They usually suggested that use as a fertiliser was 'less important' than producing energy, or that the use as an energy source would be 'eco-friendly', apparently not realising that use as a fertiliser is also 'eco-friendly'. Those students who referred to the use of antibiotics on cattle in the super farm and their passage into the human food supply often suggested that this would cause 'humans to become immune to antibiotics' and so failed to gain this potential mark. Furthermore, references to the spread of disease were only infrequently comparative, many students omitted to suggest that the proximity between cattle on the super farm would make them *more* likely to suffer from diseases. Ethics was a main focus for many students who gained the mark for explaining that the small area available to cattle in the super farm could be viewed as 'unethical' or 'inhumane', although some believed that merely keeping cattle indoors rather than outside would be unethical, that cows should be 'free to roam', or that, when cattle are kept outdoors the milk would be 'organic'. Providing energy for 2 000 homes was recognised as an advantage of the super farm, but relatively few explained that this would be a 'renewable' resource or that 'less fossil fuels' would need to be used. Indeed some believed that the super farm would be providing this energy 'free to local people'. Fewer still realised the loss of fertiliser to fields was a disadvantage of the super farm or that this would result in the need for artificial fertiliser to replace it or that without this crops would grow less well. Although many students recognised the need to give a conclusion, some missed the instruction.

These conclusions frequently failed to give an opinion and could not be credited. The examiners awarded the mark for the conclusion irrespective of whether students were in favour of, or against the super farm, provided there was clear reference to both an advantage and a disadvantage and some indication that advantages outweighed disadvantages (or vice versa). Some students ruled themselves out of this mark by only referring to advantages *or* disadvantages, without showing that the decision was a balance of the two sides.

(b) This part should have been a fairly straightforward recall of the relevant parts of the carbon cycle. On this basis, it is surprising how many students failed to refer to at least two of 'microorganisms', 'decomposition', 'respiration' or the 'release of carbon dioxide'. Those students who were confident and recognised what was required often made all four points in the first two or three lines of their answer, although filled up more of the space by repeating this. Slightly weaker students continued their journey through the carbon cycle, quoting every stage they could, including the combustion of fossil fuels, whilst others suggested that microorganisms would release carbon directly into the soil for absorption by plant roots.

Question 6 *(Standard / High Demand)*

Following on from question **5(a)** where many students appeared to show little understanding of dimensions (litres and m^2), many students suggested that an air temperature of 35.5^oC in the rainforest was 'cold', so that there would be a need for the scientists there to 'warm up', resulting in them having a higher core temperature than the scientists in the desert. Many students did realise that wind speed or the moisture content of the air were important, although often failed to make the necessary comparison, stating only, for example, that wind speed in the desert was 'high' rather than 'high*er* than that in the rainforest'. The development of this comparison into a correct explanation, as required in the question, was less common. Many believed that a higher wind speed itself would have a 'greater cooling effect', offering no explanation as to why, in terms of a 'higher rate of evaporation of sweat'. Others inevitably failed to read the information that in both cases the scientists 'sweat a lot' and suggested that the scientists in the rainforest would sweat more, resulting in a 'higher body temperature'.

(b) The usual misconceptions regarding control of body temperature resurfaced. As described in the specification, it is the 'dilation of blood vessels that supply the capillaries' which is responsible for the decrease in body temperature and not the 'dilation of the capillaries' or the 'blood vessels' which implies all of them (which would include the capillaries). Furthermore students often referred to blood vessels moving closer to the surface, indeed, so convincing and frequent were some of these descriptions that examiners sometimes wondered whether these misconceptions are derived only from poor revision. The second mark in this part required a reference to increased blood flow in the skin along with an increase of heat loss. Good students explained this well, but weaker students often only gave one part of the description. A few students, either unsure of the answer or not having read the question carefully enough described the mechanism for increased heat loss *and* increased heat retention and had thus contradicted their answer, and lost possibly both marks. Students are again reminded that they must read the question carefully and attempt to answer only what they have been asked.

Question 7 *(High Demand)*

(a) The majority of students answered this part correctly, most commonly with 7:30am and 7:30pm. A minority lost the mark by failing to give units despite the correct values. Other students gave widely differing answers with little apparent logic to the times given, for example 'midnight' and 'midday', suggesting an inability to interpret the graph. A number of students quoted values just outside the accepted range,

notably 7:50am to 7:50pm probably through reading the scale in terms of decimal values.

(b) Students struggled in this part. Many left **(b)(i)** blank, meaning that part **(b)(ii)** became even more difficult. Part **(b)(i)** should have been quite straightforward, with '11' units of carbon dioxide released during respiration.

(b) (ii) This part required students to recognise that in the light *both* respiration *and* photosynthesis are occurring and that not only will plants take in carbon dioxide from the atmosphere but also use up that which is released by respiration. Thus they had to add together the value for respiration with the intake at 3pm. The most common answer in part **(b)** was, by far, '22' showing that at least students had read the correct part of the graph, but had fallen into the frequent misconception that plants 'respire at night and photosynthesise in the day'. Provided that students correctly added 22 to the value they had given in part **(b)(i)**, the mark was awarded in **(b)(ii)**, however, if no response was given in **(b)(i)**, only the correct answer, '33' was accepted in **(b)(ii)**. Examiners have come to expect a number of students to reverse the gaseous input and output in photosynthesis and respiration. However the frequency of this error was even more surprising.

(c) Students had been reminded in part **(b)** of the correct direction of these reactions. Only the best students realised that the cause of a greater intake than release of carbon dioxide would be due to greater photosynthesis than respiration, with many simply stating that 'more photosynthesis' would happen, without the necessary comparison. Those who did gain a mark here generally did so by explaining that this would allow the plant to 'grow'. The weakness of biological knowledge, of a not insignificant number of students, was further exemplified here with a number of suggestions that the greater intake, than release, of carbon dioxide would 'allow carbon dioxide to be stored' and that 'the plant could then photosynthesise in the dark'.

Question 8 *(High Demand)*

(a) Very few students gained full marks. Responses were frequently disorganised with lots of crossed out attempts at Punnett squares, perhaps due to students trying out, then rejecting, different solutions. A significant number of students correctly showed the genotypes of A and B in a punnet square, but then copied these incorrectly onto the answer line and so lost the mark. However, more students gained a mark for correctly working out the genotypes of A and B than they did for getting any of the other marking points. Some students showed good use of genetics terminology such as heterozygous, genotype, dominant and recessive, and some gained marks from clear, well annotated Punnett squares. The best students gave their answers in a simple and direct form, but these were not common, most missing out vital components of a complete response. Perhaps the most common error, from students who appeared to recognise how to answer this question, was to omit the point that polydactyly is caused by the dominant allele, many seeming to assume, incorrectly, they had been given this information in the stem of the question. Almost all students used the symbols, H and h, as directed, although those who did not were still credited, even without a key providing they used the normal convention regarding such symbols.

(b) There were very few clear, well-explained responses overall.

(b) (i) This part was frequently correct, good explanations were much less common. Students must remember that they will not gain marks for simply repeating information from the question stem – in this instance, 'H is dominant' gained no mark,

but ‘polydactyly is dominant’ did. A significant number of students stated that the inheritance of alleles is ‘down to chance’ or ‘is only a probability’, but didn’t specifically refer to the chance of inheriting the dominant allele from the heterozygous parent. Despite evidence to the contrary on the family tree, a surprisingly high number of students simply stated that it ‘is not possible to tell whether polydactyly is dominant or recessive’.

Grade boundaries and cumulative percentage grades are available on the **Results statistics** page of the AQA website

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