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General Certificate of Secondary Education

Additional Science 4463 / Biology 4411

BLY2H Unit Biology 2

Report on the Examination

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Additional Science / Biology
Higher Tier BLY2H

General

The examiners continue to express concern over the number of candidates who achieve very low marks and for whom the experience of working their way through the paper must have been very dispiriting. For many of these candidates the quality of written response to just about every question was such as to clearly indicate that the Foundation Tier examination would have been a much more appropriate choice.

It was disappointing to note that a significant number of candidates failed to answer the questions on the back page. From the amount of writing in the rest of the paper this appears not to have been due to lack of time, but rather failure to respond to the two instructions to turn over on the penultimate page.

Fewer candidates wrote answers using inappropriate colours or pencil and, as a result, the scanned images were generally easy to read. It should be emphasised, however, that, to ensure clarity, the candidates should continue to be reminded to use black ink or ball-point pen throughout the paper.

Spaces given for responses are always more than adequate, even if half the response is crossed out, but some candidates continue to write excessive amounts. A restatement of question details gains no credit, wastes time and lulls candidates into the false belief that something of value has been written. Centres should continue to encourage candidates to answer concisely and appropriately. It was pleasing to note, however, that despite these occasional over-lengthy responses, the great majority of candidates were aware of the need to write away from the margins of the paper to ensure everything could be scanned.

Thorough reading of questions continues to be very important. It is imperative, too, that candidates appreciate the significance of any command words which are given. Descriptions of structures or data, for example, are unlikely to gain credit in answer to questions where candidates have been asked to explain, eg question 6 (b). Careless reading of instructions in, eg, question 5 (b) contributions made to *change* in temperature, and question 6 (b), results shown in *table 2*, also led some candidates to give inappropriate answers.

The language used in responses was generally clear but occasionally ambiguous. Answers sometimes required the use of comparative words, such as more, most, better, as in question 4 (b)(ii) and marks were missed where candidates failed to fully qualify statements they made. Candidates should also ensure that they do not contradict themselves in answers by making simple errors such as equating acidity with high pH or vice versa. The term amount was seen from many candidates when attempting to describe a scientific quantity. The use of more appropriate terms for number, volume, length, etc would improve the clarity of candidate responses.

Question 1 *(Standard Demand)*

(a) The distracters proved to be relatively unpopular, with the majority of candidates able to get off to a sound start.

(b) This part proved to be more demanding with candidates often showing a lack of security in their understanding of the terminology expected and of experimental procedures. It might be expected that a large percentage of candidates had experienced an investigation much like that shown in the diagram and this question was not intended to assess their ability to analyse the experimental set up.

(b) (i) Candidates regularly confused the need to maintain the independent variable at a fixed point for each setting with control variables which should be kept the same for all settings. Thus many candidates selected temperature as their first choice, while others suggested time; neither of which were awarded marks. Furthermore, those candidates who suggested the rather vague amount of water also went unrewarded, as the volume of water in the beaker will have little real significance over the period of the investigation. However, those who added in the test tube to their suggestion were given one of the marks.

Many candidates also gained one of the marks here for reference to the amount of pondweed, with the examiners seeing a wide variety of means of measuring this, including length, mass and number of leaves, although amount was accepted in reference to the pondweed. Better candidates, recognising that other limiting factors will influence the rate of photosynthesis, selected light and carbon dioxide, although relatively few added intensity to the former or concentration to the latter. The examiners reported very few references to pH or light wavelength.

(b) (ii) As previously stated, most candidates will probably have carried out an investigation such as this, in which they counted or collected bubbles over a set time period. However, the ability to convert this hands-on experience into answers was disappointing. It was obvious, from the number of candidates offering both time and bubble number on the first line, that many candidates did not recognise time as a measurement. Many of these candidates went on to suggest temperature on the second line, disqualifying one of their marks.

A few candidates, carefully avoiding what were hoped to be obvious visual clues in the diagram, suggested alternative ways of measuring photosynthesis; these included measuring the length of the pondweed before and after, measuring the volume of water or testing the amount of glucose in the plant, none of which were accepted. Disappointingly a significant minority of candidates, showing poor knowledge of photosynthesis, realised that counting bubbles was important, but then stated that the bubbles would contain carbon dioxide, which cost them this mark.

(c) (i) Although most candidates correctly identified temperature, almost all other possible factors were mentioned, including light, water, carbon dioxide and oxygen. A few candidates chose to hedge their bets with two suggestions; in such cases it is almost inevitable that no marks will be awarded, as the nature of the question suggests that there is only one correct answer, so lists which include incorrect factors will lose any mark already or subsequently obtained.

(c) (ii) The opportunity of the choices provided allowed most candidates to select the correct one, although again, lists of answers were not accepted, irrespective of the order in which the factors were written.

Question 2 *(Standard Demand)*

It appeared that some candidates were unfamiliar with the nature of a Sankey diagram. However, it was clear that a large proportion had made good efforts to interpret the diagram, which is in reality a modified graph format.

(a) (i) The most common errors appeared to derive, not from a lack of understanding of the diagram, but from poor reading of the scale, perhaps mixing up the 2mm scale of the grid with each of these scale division representing 2MJ. Hence it was not uncommon for 10 to be given here. Others chose the wrong part of the diagram, suggesting 8 or 16, depending on how many errors they had managed to work into this one mark question.

(a) (ii) Here similar errors were seen so that answers of 5% were not uncommon. A further common error included giving the amount 4MJ, rather than converting this to a proportion of the input.

There was a whole range of acceptable alternatives of the correct proportion, although those selecting 1:10 were not given the two marks as this ratio is incorrect. Candidates should beware that writing multiple formats on the answer line takes the chance that none is wrong, as this, for example 10%, 1/10, 0.1, 1:10 would cancel the mark. In addition there were many involved and unfathomable calculations. Candidates are advised to show clearly how they work out their answer, both in the question and on the front of the paper.

Candidates should be encouraged to indicate the numbers they have selected from graphs, tables etc and to show the calculation that they have carried out. In this particular case there were a significant number of candidates who scored one mark for identifying 4 and 40, or their equivalents in their working and despite incorrect mathematics, were awarded one mark. On the other hand, there were some who gave the answer 10 with no evidence as to how they arrived at it, no marks being awarded here as it does not indicate a proportion.

(b) It was important that candidates read the question in this part. In this case uses of energy was required, so answers referring to energy losses, such as excretion, waste, urine and faeces were common but were not acceptable. A number insisted that energy is used for respiration, despite the question phrasing, hence suggesting that energy simply goes in and out of respiration on a cycle!

Unexpectedly, a number of examiners reported that candidates believe herbivores to be plants, as there were descriptions of energy being used in photosynthesis or the herbivore taking in carbon dioxide to convert into sugar. Clearly these candidates had, at best, only glanced at the information in the first line of the question.

Despite this, many candidates did give two sensible suggestions, most commonly for heat and for movement. Even so, it was noted that a significant number of candidates gave movement along with an example of a movement, such as breathing, in which case only one mark was awarded.

(c) References to the method of feeding were expected in this part, with carnivores expending more energy in movement, than herbivores. Candidates who did not recognise the significance of the difference in feeding methods gave a wide variety of suggestions, including differences in the digestion process or amount of waste produced, that meat contains more energy, overall size, although the use of proportion ruled this out, and implications that herbivores are cold-blooded so needed less energy to maintain body temperature. In addition there were references to the animal's position in the food chain, such as less energy at the end or even that the carnivore gets all the energy of the grass as well as the herbivore.

(d) Candidates could answer without reference to the diagram. It was hoped that candidates would build on their response to part (b) by explaining that animals kept indoors would be using less of the energy from food in movement or in generating heat.

All but the weakest candidates achieved at least one of these marks, although there was a significant minority describing potential improved feeding regimes indoors. For those candidates who suggested ideas such as warmer indoors it was not clear whether they were referring to the environmental conditions, correct, or the animals themselves, potentially incorrect, assuming the answer refers to core temperature and that the animals are warm-blooded.

Question 3 ***(Standard Demand)***

(a) This was expected to be a straightforward starter but proved to be anything but, for a wide range of candidates. However, the idea that respiration releases carbon dioxide and that this enters the atmosphere seems not to have been well revised, as every lettered process on the diagram was suggested.

(b) In this part many candidates displayed a disappointing knowledge of the most basic chemistry. Suggestions such as the regularly occurring oxygen and water, along with nitrogen and hydrocarbons and a range of invented chemicals such as carbon hydroxide show that these candidates appear to have little understanding as to what either carbon or a compound is or the types of chemicals one might reasonably expect to find in a plant.

Two mark answers were commonly glucose and starch, with a good number of other acceptable compounds named, however, those candidates who gave one general suggestion, such as carbohydrate along with an example from that group were only awarded the one mark.

(c) It was evident that many candidates had learned that carbon dioxide is released by decomposers and thought that this would enhance the rate of photosynthesis of plants grown in compost. Many were aware that compost helps to recycle carbon compounds generally and thought that these, perhaps along with the carbon dioxide could be absorbed through the roots of plants. Others believed that the heat generated by microorganisms in compost would warm the soil and enhance plant growth. Much of these ideas are ruled out by the question referring to decayed compost, which is compost that has already completed the decay process.

A relatively large number of candidates failed to gain the second mark, mainly it is expected through poor examination technique, rather than poor knowledge or understanding. It was common for candidates to suggest that the minerals would be for plant growth not recognising that most plants grow reasonably well in a garden without the addition of decayed compost and that the compost will help them to grow better and that they will be healthier. Whilst others believed that the compost simply fertilises the soil or improves the health of the soil. It was evident on this fairly straightforward question that candidates need to think carefully and logically if they are to gain the marks they are capable of.

Question 4 ***(High Demand)***

(a) The examiners were looking for a clear understanding that increased diffusion may be achieved by increased surface area. However, there appears to be some confusion as to what diffusion is, many believing that it requires energy, suggesting that the high numbers of mitochondria in cell C would provide the necessary energy to drive the process. The diagrams also caused difficulties, with candidates sometimes thinking that the dots, keyed as ribosomes, represented concentrations of substances; this latter resulting in candidates suggesting inward diffusion to cell A, as it has a low concentration, or outward diffusion from cell C, due to its high concentration.

Although there were many descriptions of the microvilli on cell B, knowledge of this term is not required in the specification, so terms such as stringy extensions were accepted, if linked to the explanation regarding increased surface area. Those who believed these provided channels or openings or were used to draw in substances did not gain the mark.

A few conferred unexpected structures on their chosen cell, offering stomata, root hairs or guard cells or described parts of the cell wall, despite being told the diagrams represented cells of human origin.

(b) (i) Most candidates were able to name a suitable substance, with insulin by far the most common, followed by protease and amylase. A few managed to spell glucagon correctly but there were also several unacceptable hybrids of this and glucose or glycogen.

(b) (ii) This part gave the candidates the opportunity to make a simple observation of cell C and link it to their understanding. A good majority of candidates recognised the significance of lots of ribosomes and went on to explain that these are involved in protein synthesis. However, some only repeated the substance they had named in part (b)(i) and did not gain the second mark.

Those candidates who chose to go down the more mitochondria route frequently failed to link the energy release to protein production. A surprising number of candidates missed the large numbers of organelles in cell C and decided that the excretory vesicles in the upper membrane were active sites for the attachment of substrates, showing a complete misunderstanding of the differences in scale of enzyme and cell.

A minority of candidates reversed the functions of the organelles, suggesting that mitochondria produce protein or that ribosomes release energy.

Question 5 *(High Demand)*

It was intended that part (a) should be fairly straightforward, requiring only recall of well-learned facts, but that part (b), in particular, should be more demanding and discriminate at the upper end of the mark range.

(a) (i) This was correctly answered by two thirds of the candidates.

(a) (ii) The vast majority, candidates knew the answer here.

(a) (iii) Candidates appeared less confident in this part, often confusing urea with urine and quoting a list of substances in urine, including water, salts and urea itself, along with a range of incorrect substances such as the amino acids and protein. These last two would have scored the mark if candidates had read the question more carefully and restricted answers to just these. A few excellent candidates gave detailed descriptions of much of the ornithine cycle, but could still only score the one mark.

(b) As expected, proved to be demanding for all but the best candidates, and although there were few complete blank spaces, it was evident that many had only partly read the question and/or information. Omitting the last four words, shown on the graph, in the stem of the question put a completely different slant on the type of answer given. It was this that, it appeared, most candidates had done, as there were extensive and detailed explanations of how the evaporation of sweat leads to a cooling effect. Unfortunately for these candidates the information in the graph showed an increase in skin temperature, which can only be explained, in terms of the sweat glands, by a reduction in sweat production.

Examiners were surprised by how many candidates carefully described how the skin would be cooled, which diametrically opposed the evidence in the graph. Some candidates, who did refer to the graph, yet still insisted on describing additional sweat production, tried to explain the rise in temperature in terms of heat coming to the skin from the core, to evaporate the sweat. It was also evident that a significant minority of candidates believe that the blood is at a considerably different temperature to the tissues through which it flows.

A number of candidates, again perhaps not using the information, described both sides of the sweat story, increase when too hot and decrease when too cold, leaving the examiner to choose which to mark. Unfortunately for the candidate this is not in the examiners' remit and no mark is awarded unless there was a clearly stated link to the drink.

It was of particular note that a considerable number of candidates crossed out their original answers, continuing on additional paper to give the correct explanation. Clearly these candidates had had second thoughts, perhaps as they worked their way through part (c) and realised that their original explanation was the reverse of what was really happening.

(c) Candidates again often contradicted themselves between the two sub-sections.

(c) (i) Should have been a piece of simple recall for most candidates, however there was considerable misunderstanding of the terms constrict and dilate, with many answers quoting one of these and then going on to describe the opposite, for example they dilate and get narrower. There is a widespread misunderstanding that blood vessels move through the skin to allow temperature control.

(c) (ii) It was surprising, again, how many candidates failed to read the question properly, as it refers to *this change* in the blood vessels. Hence, having previously described constriction in part (c)(i), it might be expected that answers would follow on and explain how constriction of blood vessels reduces heat loss. This was often not the case, as candidates frequently began their answers with the opposite effect. Those candidates who suggested that blood vessels go deeper into the skin, in part (c)(i) were still able to gain the mark in part (c)(ii).

Question 6 *(High Demand)*

There are some candidates who believe that every question will include aspects of How Science Works, so here there were not infrequent references to anomalous results.

(a) Candidates were expected to know that the stomach contents are acidic and to recognise that lactase digests lactose more quickly in alkali conditions. A number of candidates showed confusion with the pH scale and its meaning, suggesting that low pH is alkali or that pH can be strong or weak. It was not uncommon to read statements which demonstrated a poor understanding of both the digestive system and the sequence of organs, everything is digested before food enters the stomach or that kidneys digest lactose.

(b) Many answers suggested confusion between the command words explain and describe, as there were many, particularly weaker, candidates who described every result in terms of temperature and time, explaining how time might have increased, decreased or even, the impossible, got faster.

Those candidates who realised that an explanation was required often omitted to explain the effect of increasing temperature below 45 °C, thus restricting themselves to a maximum of two marks. Some candidates suggested that both low and high temperatures cause denaturation, a misconception that cost marks at both ends of the temperature scale.

Pleasingly, killed enzyme statements were uncommon. It was here, especially, that candidates believed results are wrong, largely because they have learned that enzymes work best at 37 °C. Some candidates decided to hedge their bets around the optimum temperature by suggesting that it was in the range 40–45 °C, another misreading of the data, costing possible marks.

(c) In this part, knowledge of the alkaline nature of bile and its effect on enzyme action are clear expectations in the specification. The further function of bile, the emulsification of fats, is not expected knowledge, although many candidates knew this and were rewarded. Bile appears to have been a substance omitted from revision by a number of candidates who could get no further than the speculative it contains enzymes or it is acid, whilst others appeared unsure as to the structure of the alimentary canal, suggesting that bile enters the stomach, despite the information in the question stem.

Question 7 *(High Demand)*

(a) The key to this part is that in body cells chromosomes are found as pairs. Many candidates expressed this succinctly; however others went down a mathematical route, explaining that two odd numbers always make an even number or that there are 23 from the mother and 23 from the father, making 46. Neither of these ideas, although showing some measure of understanding, was considered to be worthy of the mark, as they do not recognise the importance of gametes having one of each pair rather than, in humans for example, any assorted 23 chromosomes.

(b) Answers to this part were as disappointing as the last time a question of this kind was asked. Very few candidates appeared to have included this topic in their revision, as vague statements were common. Most often a mark was gained for the general idea that DNA controls characteristics or appearance.

However, the question asked for the *function* of DNA so the high number of answers which stated that it was unique, a personal identifier, inherited from parents or used in crime scenes or paternity cases gained no credit. The idea that DNA holds genetic information, chromosomes or genes was also insufficient.

A significant number of candidates were able to state that DNA contains a code, but very few were able to say that this determines the sequence of amino acids needed to build a specific protein. Too many candidates believe that the DNA itself is made up of amino acids or protein, some even going so far as to say that the order of amino acids in the DNA is the code.

(c) (i) Most candidates successfully negotiated this part of the question.

(c) (ii) Candidates often showed poor understanding or simply ignored the information in the table, referring to the human condition of 23 chromosomes in the gametes. A significant number also suggested that the gametes contain four chromosomes, perhaps confusing the number of cells produced in meiosis, or even two, the number of gametes involved in fertilisation.

(d) (i) Further misconceptions were revealed here, most commonly that mitosis allows cells to repair themselves or to grow; neither of these being correct. However a good proportion of candidates avoided this and often gave good specific descriptions of tissue repair after injury or replacement of worn out or old cells. Some candidates chose to mention that cell division made sure that the cells produced had the correct number of chromosomes, which showed they had not read the question!

(d) (ii) The errors shown in part (c)(ii) reappeared in this part, with 46 being a frequent wrong answer, along with 2.

Mark Ranges and Award of Grades

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