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General Certificate of Secondary Education

Additional Science 4463 / Biology 4411

BLY2H Unit Biology 2

Report on the Examination

2012 examination – January series

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Additional Science / Biology
Higher Tier BLY2H

General

This examination paper was slightly more demanding than some recent papers for this specification, with students' analytical skills called into use more often than in the past couple of sessions. However many students rose to the demands and some very pleasing responses were given throughout the paper.

As previously, there is a small but significant minority of students who had been entered for the Higher Tier paper when they should clearly have been entered for Foundation Tier. Marks of below 10 out of the 45 available were achieved by almost 2000 students who would almost certainly have gained more confidence from entering a more appropriate paper.

A number of examiners noted deterioration in students writing and presentation and there was frequent need for examiners to refer scripts due to illegibility, sometimes because students had written so faintly that scanning produced very low contrast. Students should be reminded that the answers should be written in black ink or black ball-pen. Some students wrote answers outside the frame on the page and should be aware that the instruction 'Answers written in the margins or on blank pages will not be marked' allied to the reminder 'Do not write outside the box' on each page are there for a reason.

Each year students are reminded to pay particular attention to command words: 'name', 'describe', 'explain', 'suggest' and 'evaluate' all have significance in directing students towards the approach they need to take to gain marks. Furthermore, instructions such as 'use data from…' are intended to alert students as to what is needed in an answer and to give them every opportunity of accessing the complete range of marks. There is now an AQA information booklet concerning the use of command words in Science examinations on the AQA website in the new Science area.

Question 1 *(Standard Demand)*

(a) (i) A large majority of students correctly described the trend shown by the table. It was evident that some had not read the question carefully and described both the effect of the wind and temperature on the time taken to get frostbite. However, in these cases, the examiners ignored references to the wind. Examiners were also prepared to accept the relationship described in a number of ways, both in terms of the time to get frostbite and the 'chances of getting frostbite' and this ensured that students, who recognised the relationship but described it poorly, would gain the mark. In addition those students who answered with responses such as 'the time (to get frostbite) would be faster at lower temperatures' were also given the mark. A few students only described the effect of wind on time taken or even the effect of wind on temperature and did not gain the mark. The weakest students did not recognise the need to describe the direction of temperature change with answers such as 'when the temperature changes the time taken to get frostbite is less' and, of course, failed to gain the mark. Weaker students also misread the temperature scale and arrived at the suggestion that 'increasing temperature increases the chance of frostbite'. It is important that students should read their answers carefully to ensure they make sense and are logical.

(a) **(ii)** Poor reading of the information in the table and the associated key meant that many students failed to score the mark in (a)(ii). The table shows that being outside for 5 minutes in the conditions described would not result in frostbite, but that being outside for 10 minutes would result in frostbite. Hence the longest safe time (i.e. when frostbite would *not* occur) must be somewhere *between* 5 and 10 minutes. Many students, though, chose '10 minutes', a time when frostbite would occur. The examiners also accepted an answer of '5 minutes' as the table does not give evidence about any time between 5 and 10 minutes.

(b) Virtually all students identified at least one of the correct changes in part (b), and the great majority gave both. The most common error was to substitute the first choice 'More blood flows through skin capillaries' (which would lead to greater heat loss) for the third choice 'Blood vessels supplying the skin capillaries constrict'. Unfortunately a few students ignored the instruction to 'tick two boxes' and ticked only one or occasionally three and thus limited themselves to a maximum of one mark.

Question 2 *(Standard Demand)*

(a) The majority of students understood what was meant by 'control variable' and gave an appropriate answer. By far the most common answer was 'the amount of (crushed) apple', described in a variety of ways. Others decided to go for describing the solutions that were added, however these had to be more careful as 'drops' alone was insufficient and reference to 10 drops of just *one* of the solutions (water / amylase / pectinase) was clearly incorrect, as this is one of the values of the independent variable. A few students misinterpreted the instruction and chose a variable, such as 'temperature', which it might well have been sensible to control in the investigation but had not actually been controlled.

(b) In part (b), students who did not seem familiar with the significance of the term 'accurate' in the question often chose the wrong reason, with 'miscounting' or other examples of possible human error, being common. However a good proportion of students showed clear understanding and referred to the possibility of differences in the volumes of drops and some went further to explain this in terms of differing viscosity of the various solutions.

(c) Part (c) proved to be more problematic. In the first case many students demonstrated poor examination technique, misinterpreting the command word 'explain' and instead filling the lines and much of the space beyond with lengthy descriptions of the results. Unfortunately these gained no marks. The examiners were looking, in the first place, for an understanding that enzymes might 'break down' or 'digest' the apple. The difference between the volume of juice released due to the action of the two enzymes must be due to amylase (for which the result was identical to that of water alone) being unable to break down the apple, whereas pectinase must have broken down the apple. Furthermore, the action of boiling (which released a similar volume of juice to that of pectinase) must also have broken down the apple. Students might have carried forward the information that releasing juice from the apple requires cell walls in the apple to be broken down, but this was not essential to them being able to answer the question fully. Good students did well here, but weaker ones rarely got further than a description of the results.

(d) Part (d) tested students' powers of logical deduction. Although many recognised that boiling would denature the enzyme, the value they predicted for the volume of juice collected often did not match the other information. Many forgot that although the enzyme would be ineffective, boiling would still allow juice to be collected; these students often chose 1.2cm^3 or sometimes 11.3cm^3. Students who suggested the latter of these values often give the impression they did not know the difference between 'boiling' and 'heating', suggesting that the enzyme would continue to work until the temperature of the apple got 'above 45 °C'. Of those students who did select the right volume many omitted to explain that this volume would be due to the effect of boiling alone.

Question 3 *(Standard Demand)*

(a) In part (a) students were expected to sort out the information regarding the side effects of the four drugs, all of which are real side effects (although only some of them) of real drugs used in the treatment of diabetes. Those who spotted that drug 'B' might damage cells in the pancreas gained the first mark, and by linking this to the role of the pancreas, usually gained the second mark, however the idea that 'the pancreas controls blood sugar levels' was considered to be insufficient, as students presumably failed to recognise the subtle difference between 'controlling' and 'monitoring'. It was not sufficient, however, merely to restate the information in the table, 'damage to some cells in the pancreas', as in order to gain marks, value must be added to the information provided. The alternative 2-mark answer that 'drug A might damage the liver so less sugar would be stored' was only an occasional suggestion.

(b) (i) In part (b)(i), those students who recognised the link between protein in the tablet and potential digestion generally gained this mark. However, those who believed that protein might be digested 'in the mouth' or 'by amylase' lost that credit. A range of other suggestions, all of which failed to gain the mark, included frequent references to the need 'to inject insulin'.

(b) (ii) Most students could give at least one method of treating diabetes, in part (b)(ii), usually referring to 'attention to diet', in a variety of ways, although some believed increasing sugar content of food would help. Further correct suggestions included the advantage of exercise (in using blood sugar) and stem cell or whole pancreas transplants. Those who did not gain a second mark usually suggested insulin injections, although this had been ruled out by the information in the question or gave a second, usually overlapping, dietary method or suggested transplanting the wrong organ.

Question 4 *(Standard / High Demand)*

(a) Most students realised that the evidence was based on there being 'more carbon dioxide in the jar' or 'less carbon dioxide used' on Day 1. Many of these went on to explain that this was due to there being less photosynthesis on Day 1 and some went a little further to indicate that light was the limiting factor here. Weaker students sometimes referred to 'no photosynthesis' which was difficult to defend on the basis of the graph, although these often thought that the plant would 'respire more' when there was less light. Examiners presume that such students might be under the common misconception that 'plants photosynthesise in the light and respire at night'. Others became confused between photosynthesis and respiration, suggesting that 'plants give off carbon dioxide when they photosynthesise'.

(b) In part (b), a high proportion of students correctly identified 'magnesium' or, more rarely 'iron', although a good range of alternatives was suggested.

Question 5 *(Standard / High Demand)*

(a) An unexpectedly high number of students failed to select the right figures from the information, with virtually every number from the food chain tried out in one calculation or another. The choice of '45' and '25000' should have been straightforward, only leaving students to decide how to construct the calculation. Having selected the correct numbers all that was required was to construct the correct calculation. Having got this far, most students managed to complete the calculation, remembering to include 'x100' in their figures in order to arrive at a percentage. For those who created other calculations, final answers well in excess of 100% presumably did not seem strange, as there were few obvious attempts to re-calculate or amend them.

(b) Disappointingly, part (b) was poorly done, with large numbers of students offering 'respiration', perhaps unaware that respiration is not a 'form of energy'.

(c) Students appeared a little more secure in part (c), with most referring to energy lost or used at each step along the food chain. This was usually supported by the idea that 'there will not be much left at the end' which failed to match the instruction to 'use data from the diagram'. Those who realised that marks could be gained from following the instructions usually referred to data for the heron, indicating that only 2kJ per m^2 per year would be left or that the heron could only pass on less than 1kJ per m^2 per year. Some students went as far as to calculate the percentage of the original energy left for the heron and these calculations almost always gave the correct figure, '0.008%'. Examiners were not convinced by many explanations of the use of energy along the food chain, with frequent references to energy being 'used for respiration' however, on this occasion such a suggestion was overlooked as this was not the focus of the question.

(d) An explanation of the relevant part of the carbon cycle would have been enough to gain all three marks in part (d). The phrasing of the question also meant that students could refer to mineral salt recycling in their answer. Many students did well here and could have gained four marks had there been more marks available. However the usual misconceptions about the carbon cycle allied to poor expression often let students down. Most students referred to 'decay' and many also knew that this was carried out by the microorganisms identified in the question. What was less well known was that the microorganisms carry out respiration, although this was indicated on the diagram, and that respiration releases carbon dioxide.

Question 6 *(Standard / High Demand)*

(a) It is to be noted that part (a) requires an explanation. As such answers may only be awarded full marks if a full explanation is given. Part (a) was intended to be a fairly straightforward application of the principle of osmosis to a traditional situation that many students are likely have seen as a simple demonstration. Although most students referred to 'osmosis' in their explanations, many merely repeated the definition they had learned and made no reference to the particular situation. Those who did this gained no further marks, as both the first and the third marking points in the mark scheme required a link to the investigation. The term 'concentration' proved to be a stumbling block for many students who failed to make clear as to which concentration they were describing. It can only be assumed that an unqualified reference to 'concentration' refers to solute concentration. Thus students who describe 'water moving from a high concentration to a low concentration area' are incorrect. It is evident that an increasing number of students are taught osmosis in terms of water concentration and this is, of course, perfectly acceptable and logical. It is important, however, that students remember to repeatedly refer to 'water concentration' in their answers. Despite usually identifying osmosis, weaker students referred to the movement of 'water', 'sugar', 'substance', 'sugar solution' and 'solution' with little discrimination and when wrongly attributed often lost any credit they might have gained. Even for those who realised that only water was moving, the direction of movement of this water was often left to the examiner to deduce, as some students appeared to be under the misapprehension that concentrated sugar solution does not contain any water. Despite so many potential pitfalls for those students who were unsure of the facts or had difficulty expressing their ideas coherently examiners were pleased that there were some excellent answers from good students with some of the best responses written simply and succinctly on three lines or less.

(b) Examiners expressed surprise at students' inability to describe simple ideas, when attempting to gain the first marking point. There is a considerable difference between 'the level rises less' and 'the level goes down', yet many students, who by their explanations appeared to mean the former, actually wrote the latter, thus costing them the first mark. In attempting to explain their ideas students again showed insecurity with the concept of concentration. Many suggested that in this situation, sugar would pass through the membrane as it was now 'less concentrated than the water'! Once more there were some excellent answers with good students describing the 'lower concentration gradient' than in the first investigation.

Question 7 *(High Demand)*

The bulk of this question was aimed at testing potential grade A* students' ability to analyse unfamiliar information. These students rose to the challenge and there were some good responses throughout. Students operating at below this level still had the opportunity to gain some of the marks, using what they had learned from the specification.

(a) Around two-thirds of students were able to identify 'gene' or 'allele' in part (a). Incorrect answers most frequently offered 'chromosomes'.

(b) Slightly fewer students could then name the cellular component where proteins are synthesised, with all manner of organelles and cells being suggested, although 'mitochondria' was the most common incorrect response.

(c) It was in part (c) where weaker students, not surprisingly, came unstuck. Students are expected to know that 'a gene codes for a particular combination of amino acids which make a specific protein'. Having been reminded in part (a) and in part (b) that this question was about making a specific protein (that for blue eye colour), students had only to convey the idea that 'proteins are composed of amino acids' for one mark and then describe 'a specific combination of amino acids' for the second mark. This second mark could be gained in a variety of ways, including quoting the amino acid sequence, 'J, K, L, M, K, N' from the diagram. A third mark could be acquired in a variety of ways, all derived from the diagram. This could have been derived from the idea that it is the 'bases that form the code', that the 'bases work in threes' or that 'this code or the three bases are involved in which amino acid goes to make the protein'. Some good students gave very succinct answers 'three bases code for one amino acid', and gained all three marks in only one line. A different and ultimately unsuccessful approach by some students was to describe what they knew of Mendelian inheritance, explaining how heterozygous parents might have a child with a recessive phenotype. Others homed in on the repeated amino acid 'K' and decided that this must be the recessive allele and that this sequence therefore 'caused blue eyes'.

(d) (i) Many responses got no further than suggesting that a 'different protein' would be synthesised. Unfortunately this was implied in the question, so gained no mark. Students who recognised that the base code varied for each different amino acid were able to suggest that the change in this code would alter the amino acid sequence and were justly rewarded. Others suggested that the protein would have a different shape and were also credited.

(d) (ii) Although many students picked up the mark in part (d)(ii) for reference to 'a different eye colour', good students showed excellent understanding of the potential effects of synthesising a different protein. Answers from such students often referred to the possibility of disruption of all manner of characteristics and processes in the body, including the potential that the change may confer advantages or disadvantages on the organism.

Question 8 *(Standard / High Demand)*

This question and the mark scheme were written to enable students to gain full marks whatever approach they took and it was pleasing to see many students rising to the challenge here and making some good attempts at the evaluation required. The majority of students compared the use of adult stem cells with the use of embryonic stem cells. Others took different approaches, including comparing the use of embryonic and / or adult stem cells to having no treatment or to having treatment by other methods. However it was often unclear which approach students had taken as they referred to particular features without identifying to which treatment they were referring.

Students should be made aware that simply copying or paraphrasing the information provided, including ascribing various parts to 'advantages' or 'disadvantages' will <u>not</u> gain marks. What is required in such questions is the addition of extra information or comparison of treatments based on the information provided. Hence statements such as 'embryonic stem cells can be used to produce any kind of cell. Bone marrow stem cells can form blood cells', gained no credit. However, the addition of a word such as 'however' or 'but' to link these two sentences would be enough to gain a mark for a comparison. Similarly adding the idea that 'embryonic stem cells can treat a wider variety of diseases' not only includes a comparison but also extends the information regarding production of any kind of cell, tissue or organ into its use in treatment and would thus gain more credit. Some students immersed themselves in the vagaries of ethics, morals or 'playing God' without developing these any further. So answers, for example,

that said 'using embryo stem cells is unethical as embryos are living' or 'it is inhumane to collect cells from embryos' gained no marks.

There was occasional confusion with embryo screening with references to wanting to select features, produce designer babies, or find out if the child would have CF, the ethics of this and the potential for parents to make choices regarding the use of, an as yet, unborn foetus. These were not credited, as being not relevant to the information in the question. Many students however, made excellent points referring to advantages and disadvantages of embryonic and adult stem cells. Unfortunately, students often wrote poor conclusions which frequently only restated pros and cons and failed to come to a decision. Answers such as 'I can see both sides' were by no means uncommon. Where conclusions to evaluations are asked for, students are expected to commit themselves to a firm decision, one way or the other, and then justify this decision. It was not unusual for students to gain extra marks for making fresh points in the conclusion.

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