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General Certificate of Secondary Education

Additional Science 4408 / Biology 4401

BL2HP Unit Biology 2

Report on the Examination

2012 examination – June series

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Additional Science / Biology
Higher Tier BL2HP

General

A lack of knowledge of key facts – for example not knowing the meaning of the term *carbohydrate*, or not knowing the function of a *ribosome*. Many students failed to distinguish between the instructions *describe* and *explain* and thus included much irrelevant material in their answers. Mathematical weakness in calculations – and, if working is omitted, sacrificing any mark that would have been available for its inclusion.

Evidence from diagrams or graphs not always being cited carefully and descriptions of patterns in graphs without including numerical values – which are needed if full marks are to be gained. A lack of appropriate detail in the description of a practical method – sufficient needs to be included to enable another person to carry out the investigation. Spelling of technical terms – this becomes particularly important for distinguishing between similar biological words, such as glycogen – glucagon – glycerol, or mitosis – meiosis.

Incorrect use of chemical symbols – although a name expressed in symbols is usually acceptable, the symbols must be correct. Re-stating information from the question without using it in some way: this should be discouraged as it gains no marks.

Question 1 *(Standard Demand)*

This was one of two question common to both the Higher and Foundation Tier papers.

(a) (i) Nearly all students were able to give at least one variable that the scientists controlled in their investigation, and three-quarters of the students gave at least two. Amongst others, the fact that the two athletes were the same age and gender was evident to many students and that they exercised for the same amount of time each day, Rather too many suggested "diet" as a control variable, this in fact being the independent variable.

(a) (ii) Only a quarter of the students could suggest two variables that it would have been difficult to control. These included various biometric attributes of the two athletes, how hard they exercised, and the amounts of exercise they took between the scheduled sessions.

(a) (iii) This part should have been very straightforward to answer but only around three-quarters could state, in any intelligible way, that athlete B had less glycogen.

(b) This question differentiated very well across the ability range.

Most realised that athlete **A** was more likely to complete the marathon due to his larger reserves of glycogen. Some then explained that this would provide him with more energy (although fewer explained that this energy would have been released in respiration). Better students knew that glycogen could be converted into glucose for use in respiration.

Question 2 *(Standard Demand)*

(a) (i) Almost two-thirds of students knew that ribosomes were the site of protein synthesis. Some clearly confused ribosomes with mitochondria and thought they were for energy release. There was also a range of curious suggestions by those who did not know the answer but were able to use their imaginations.

(a) (ii) While most could choose either the presence of a vacuole, a nucleus, or chloroplasts as a feature that distinguished the plant cell from the bacterial cell, there were many

students who selected common features, such as the cell wall, cytoplasm or cell membrane.

(b) Almost two-thirds of students were able to calculate that the length of the plant cell was 200 micrometres. This involved appropriate manipulation of the two given scale factors. Those who did this incorrectly, answering 0.02 micrometres, ought to have considered which of the two types of cell, plant or bacterium, was the larger in real life.

(b) (ii) Most students, who used their answer from part (i) as instructed, realised that a bacterium was too small to contain any mitochondria. Those who ignored this instruction invented various improbable reasons for the absence of mitochondria in bacteria, such as bacteria not needing to respire.

Question 3 *(Standard Demand)*

This was the second of the two questions common to both the Foundation and Higher Tier papers.

(a) Parts (i) and (ii) posed no difficulty to the vast majority of students who were able to select the correct plants from the diagram.

(a) (iii) This part involved a description of evidence and over a third of students gave an inadequate description: the duckweed was present in *both* the aquatic *and* the swamp regions of the stream (or *only* in areas *covered* in water), not just in "wet areas".

(b) It was evident from what most students wrote that they had little knowledge of the use of a quadrat for sampling along a transect. Many described a method involving random placing of the quadrat in an area, presumably reflecting a practical exercise they had performed but not understanding that such an approach would *not* generate data as shown in the diagram. Better students indicated that the tape measure should be laid out in a straight line and the quadrat placed at intervals along it. The best students pointed out that this should be done with the tape laid across the stream and that the exercise should be repeated, perhaps at intervals along the stream. It was surprising how few students described how the presence and absence of the different plant species (there were 8 given in the data) should be recorded each time the quadrat was placed: many students merely referred to unspecified "results" being recorded. This question differentiated very well across the ability range, but very few scored 5 or 6 marks.

Question 4 *(Standard / High Demand)*

(a) (i) Nearly three-quarters of students knew that the type of cell division occurring in a root tip, and shown in the photograph, was *mitosis*. Only the correct spelling of mitosis was allowed, to overcome ambiguities.

(a) (ii) Slightly fewer students stated that the genetic material had to duplicate, or be copied, prior to cell division.

(b) Very few students scored full marks here for their explanation of why sexual reproduction might result in a new variety of onion plant. The most common point gaining credit was that genetic material would be mixed from two sources, and yet surprisingly few went on to mention fertilisation, although many knew that gametes were produced by meiosis or that meiosis resulted in variation.

Question 5 *(High Demand)*

(a) The vast majority of students were able to complete the equation for photosynthesis correctly.

(b) (i) Just over three-quarters of students understood that, since oxygen was a product of photosynthesis, no oxygen would be produced by the leaf discs in the dark as light was needed for photosynthesis. Some students threw the mark away through careless expression and others invoked an incorrect reason, such as a lack of carbon dioxide.

(b) (ii) Less than a third of students were able to explain that the leaf discs took in oxygen in the dark because it was used in respiration. Some had some very strange ideas, such as oxygen, being O_2, would be a part of carbon dioxide (CO_2); or that, because the plant could not produce oxygen by photosynthesis, it had to take it in instead (for some unstated purpose).

(c) (i) The command word was 'Describe'. This did not prevent many students attempting an explanation – usually in terms of enzymes being denatured at higher temperatures – for which *no marks* were available. Many students described the increase in rate of oxygen production but forgot to mention the decrease at higher temperatures. Others described an increase up to 35°C and then a "decrease" between 35 and 40°, which was incorrect as the rate was still increasing and did not decrease until above 40°C. Full marks were easily available for simply stating that the rate increased up to 40°C and decreased above 40°C.

(c) (ii) This part asked students to 'Explain' the results for two temperature ranges, most merely *described* the trend. Answers for the range 25 to 35°C were particularly weak as a reference to energy and molecules , or to temperature being a limiting factor, was needed. More success was gained for the 40 to 50°C range as many students realised that enzymes or proteins would be denatured (although weaker students thought the *plant* would be denatured). Over two-thirds of students scored no marks for this question.

(d) The most common point rewarded in answer to this question was the economic argument. Very few students backed this up with an adequate explanation relating to the marginal increase in rate between 35 and 40°C. Indeed, some students appeared to believe that 35° was the optimum temperature. Unfortunately, even fewer students appreciated that the respiration rate increased faster than that of photosynthesis between 35 and 40°C, as evidenced by the widening gap between the two lines on the graph, which would reduce the effect of photosynthesis.

Question 6 *(High Demand)*

(a) In order to answer this question, a student needed first of all to explain that a fossil was the remains, or an impression, of an organism that had lived a long time ago and to explain that fossils showed changes over time, in particular being simpler than species alive today but related to present-day species as they had some features in common with them. Around two-thirds of students were able to make at least one of these points, the most frequent being that fossils had features in common with modern species.

(b) In this question, students had to apply their knowledge and understanding of natural selection and geographical isolation to explain how two species of bird could have

diverged from a common ancestor. The question allowed the best differentiation of student abilities of all the questions on the paper. The vast majority were able to make at least one point which usually related to isolation of ancestral populations. Better students then explained how surviving birds were those better adapted to their environment, perhaps pointing out that different adaptations might suit different environments. Natural selection was often invoked. The points least often mentioned were the genetic variation that might occur within an isolated population, perhaps due to mutation, and that accumulated differences between different populations might eventually result in an inability to reproduce successfully should the populations be reunited, as in the UK today. Students did not always make it clear whether they regarded adaptation to the environment as an active (Lamarckian) or passive (Darwinian) process. And very few students explained that only certain alleles would be passed on by surviving members of each population.

Question 7 *(High Demand)*

(a) Less than a quarter of students were able to give a satisfactory definition of *alleles* as variants of a single gene. More were able to explain the meaning of *recessive* as either the allele whose effect was masked by the dominant allele or as requiring two copies of the recessive allele to be present in order to be expressed.

(b) Nearly three-quarters of students deduced that the genotypes of both parents had to be **Nn** if they were to produce a child with cystic fibrosis. Genetic diagrams tended to be good, especially for students who adopted the Punnett square approach – this format seemed less prone to errors than the line diagram alternative. The most common error was a failure to identify the offspring genotype, **nn**, as the one with cystic fibrosis: it is not the examiner's job to choose this one from the four given genotypes on the student's behalf.

(c) Students were provided with information about two different methods of embryo screening. In order to evaluate which was the better method it was necessary, for each point, to make a *comparison* between the methods and to *explain* why this gave one method an advantage. For example, pre-implantation genetic diagnosis (PGD) would not lead to an abortion while chorionic villus sampling (CVS) would and so there would be less trauma for the mother with PGD, or it would be less unacceptable ethically. Relatively few students constructed their arguments along these lines. Far too many simply copied information about one of the techniques from that given in the question, followed by more copied information about the second technique. There were no marks available for this approach. The most successfully made point of comparison was that CVS had a distinct cost advantage.

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

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