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General Certificate of Secondary Education

Biology 4411

BLY3H Unit Biology 3

Report on the Examination

2012 examination – January series

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Biology
Higher Tier BLY3H

General

Particular problems which occurred quite frequently included:

- The inability to express ideas clearly and unambiguously
- Poor quality handwriting, sometimes to the point of illegibility
- Paying insufficient attention to information provided in the stem of a question in order to guide a reasoned response
- Careless reading of the question resulting in an inappropriate answer
- Not reading data accurately
- Mathematical weakness in calculations
- Limited ability to apply what has been learned to a novel situation
- Poor understanding of certain topics, such as kidney function, the relationship between glycogen and glucose.

Question 1 *(Standard Demand)*

This was the first of two standard-demand questions common to both the Foundation and Higher Tier papers.

(a) Although a majority of students knew that yeast produced carbon dioxide, a few suggested other gases, such as oxygen, methane or nitrogen. And, although a majority of students knew that either 'fermentation' (the favourite response) or respiration produced the gas, some students were obviously seeking the opportunity to use the term 'biogenesis' in one of their answers and this seemed as good a place as any!

(b) This was a high-scoring question with most students recognising that the highest gas production, which occurred at 30 °C, provided evidence that this was the best temperature.

(c) A large proportion of students understood that repetition was the thing to do in order to improve the reliability of the investigation, but far fewer were able to correlate this with the obtaining of similar results each time. Many were keen to calculate an average and also wrote about the detection or removal of anomalies rather than stressing that the *absence* of such anomalies would have been an indicator of reliability.

(d) Many students scored no marks in this section as they insisted on writing about how accurate results could have been obtained (e.g. with better instrumentation) rather than assessing whether the value stated for the best temperature was an accurate one. Some gave answers that were partially correct – suggesting the use of more temperature values – but better students stressed that these values should be clustered around 30 °C, and the best stated that temperatures separated by smaller intervals should have been used – e.g. just 1 or 2 degrees apart. Those who stated, 'Do it again at 28, 30 and 32 °C,' scored full marks for a succinct, precise answer.

Question 2 *(Standard Demand)*

This was the second of two common questions.

(a) This was a straightforward question asking for a comparison of heart rate patterns of two people displayed in the form of a graph. Inaccuracy of expression meant that many students did not score as well as they might have: for example, a description for one of the two people without a comparison with the other did not address the question. Thus, to state that the person with the muscle disease experienced a very high heart rate in the first few minutes of exercise was not mark-worthy whereas, to state that this was *higher* than the healthy person, was. The most successful students worked sequentially through the graph making comparative points. Some students felt they needed to *explain* the differences in heart rate despite the question asking only for a *description*. Students who quoted numerical values from the graph were often better able to make their points unambiguously.

(b) **(i)** Most students knew that, in addition to glucose, *oxygen* had to be transported to the muscles at a higher rate during exercise.

(b) **(ii)** Despite the difference between the two people being stated as in their ability to store glycogen in the muscles, many students insisted that there were differences in the ability to transport oxygen as well, with some even thinking that energy could be extracted from the oxygen if glycogen were unavailable. Only better students understood that glycogen was able to be interconverted with glucose and hence, in the absence of glycogen, there was greater dependency on glucose being supplied, via the blood, to enable the same amount of energy release to power the exercise. Many insisted, incorrectly, that there would have been a difference between the two people in the balance between aerobic and anaerobic respiration. Other errors included glycogen transport by the blood and irrelevant references to breathing, lactic acid production and oxygen debt.

Question 3 *(Standard / High Demand)*

(a) This question differentiated well amongst students of different ability: while many knew that transpiration involved water loss, others thought it involved other substances in addition – such as oxygen and carbon dioxide. Fewer students explained that transpiration involved *evaporation*. Many confused transpiration with the *transpiration stream*. The majority also knew that transpiration occurred mainly via the stomata. Others were less precise and gave answers like ‘the lower surface’.

(b) **(i)** Only about half the students were completely successful in their calculation of the average rate of transpiration between the two given times. A sizable proportion laboriously read off the rate for each of the seven points on the graph between these times, then divided by seven, not realising that the difference between the initial and final readings divided by the 3 hours taken would produce an average rate per hour.

(b) **(ii)** Most students realised that, between 16:00 and 19:00 hours, the amount of light, or the temperature, was decreasing in parallel with the observed decrease in the rate of transpiration. Relatively few, however, could offer a satisfactory explanation in terms of the relationship between stomatal opening and light intensity, or the rate of evaporation being dependent upon the temperature. Other possible environmental factors, such as wind and humidity, were occasionally suggested and were given due credit.

Question 4 *(Standard / High Demand)*

(a) **(i)** The majority of students knew that, in biogas production, methane was made by *anaerobic respiration* or by *fermentation* – the latter being the more common answer.

(a) **(ii)** This question differentiated well in terms of the amount of correct detail given by students. Thus, many associated the presence of air with *aerobic respiration*, but often *oxygen* in the air was not mentioned. Alternatively, *aerobic* would be omitted as the necessary qualification, in this context, for 'respiration'. While most knew that respiration produced carbon dioxide, many others thought, erroneously, that the initial air trapped in the biogas generator actually contained a high percentage of carbon dioxide.

(b) The majority of students appreciated that the methane levels were too low before the given 20 days and hence biogas production would not be worthwhile before this time.

(c) Less than half the students realised that, towards the end of the investigation, the microorganisms might be running out of organic material to ferment. Some showed lack of understanding by stating that 'oxygen' levels would have declined inside the biogas generator.

Question 5 *(Standard / High Demand)*

(a) Most students were able to make at least one or two valid points about how bacteria turn milk into yoghurt. The thickening / curdling of the milk was widely known although some thought this to be due merely to the presence of large numbers of bacteria. The production of lactic acid was the next best-known detail and the better students knew that the milk sugar, lactose, was used in the process. Some, however, confused the identities of lactose and lactic acid.

(b) Relatively few students understood that it was the acidic nature of yoghurt that preserved it from attack by other species of bacteria.

Question 6 *(Standard / High Demand)*

(a) This question differentiated very well across the ability range. Many students are very confused about the working of the kidney. It was quite common to read that *both* glucose *and* protein were too large to pass through the kidney's filter and that this might then be followed by *both* of these substances being reabsorbed back into the blood: clearly, such students could not have understood what they were writing about. Other students omitted essential details – often it was not clear whether the named substances had passed through the filter or not. Just over a quarter of the students clearly did understand the working of the kidney but the point most often missed was the partial / selective reabsorption of *some* of the mineral ions: many just indicated that 'excess' mineral ions were excreted without stating how this was achieved. Many students simply forgot about the urea or confused 'urea' and 'urine'. Those that had little idea of how the kidney functioned merely stated that substances were (somehow) retained if they were 'needed' by the body while the remainder were eliminated.

(b) This question also differentiated well but with only a tiny minority attaining full marks. Since the question was comparative, between a man on a hot and on a cold day, it required a comparative answer. The man did not sweat *only* on the hot day, he sweated *more* on that day and thus needed his kidneys to reabsorb *more* water. Many students imagined all manner of strange properties of urea and mineral ions but missed the point that it was the availability of *water* that determined whether the urine would be concentrated or dilute and that this in turn related to the degree of sweating. Others tried to answer the question in terms of the amount of urea and ions lost in sweat.

Question 7*(High Demand)*

(a) Only about 1 in 10 students appeared to understand this question and to apply it to what the scientists had actually done. Most appeared to misinterpret the question in terms of variables the scientists *should have* controlled.

(b) Most students knew that heating to 121 °C would sterilise the apparatus and growth media, although a few thought this was a good temperature at which to grow bacteria. Relatively few could explain *why* it was necessary to sterilise the equipment, such as to reduce competition for resources or to avoid toxin production.

(c) Just over half the students were able to make at least one valid point from the data. Many did not give a full evaluation, being content to note that the presence of calcium ions (or calcium chloride) was associated with an enhanced yield of the enzyme. A tiny minority were able to see that the evidence was, perhaps, ambiguous due to the number of uncontrolled variables, such as the amount of sucrose or of manganese chloride. Others did not understand that 0.01 percent calcium chloride was in fact greater than 0.005 percent. Many misinterpreted the information given and treated the percentage composition of the growth media in **Table 1** as a percentage yield of the various substances listed. Evidently many students needed to have studied the data rather more carefully.

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