Version 1

General Certificate of Education (A-level)
June 2011

Human Biology HBI3X

(Specification 2405)

Unit 3: Externally Marked Practical Assignment

Report on the Examination

Further copies of this Report on the Examination are available from: aqa.org.uk

Set and published by the Assessment and Qualifications Alliance.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales (company number 3644723) and a registered charity (registered charity number 1073334).
Registered address: AQA, Devas Street, Manchester M15 6EX.

General Comments

This was the third series for this component in the AS examination. Examiners would to like to express their gratitude for the attention given to administrative requirements by centres. There were only a few occasions where the Centre Declaration Sheet was omitted; for those that are unsure, there is a specific form for the EMPA which is slightly different from the ISA version. Similarly, there were a few cases of missing teacher or candidate signatures or of the tick against the Practical Skills Verification. Teachers are reminded that PSV only requires a tick and not a number. Although it was not a specific requirement, it was especially helpful in dealing with the different parts of the EMPA where a treasury tag had been used to hold the Tasks and Written Test together.

In general, only a modest improvement with the written components was seen. Both the table and graph proved a little more problematic than was anticipated. More detail will follow. Familiar weaknesses, like failing to answer the question asked or not providing sufficient points for the marks available continue to appear. Some centres have clearly given attention to the use and interpretation of resources. However, many candidates do themselves few favours by attempting to answer questions in Section B on face value and without reference to, or an understanding of, what is contained within the resource material.

The Teachers' Notes again offered slightly more additional guidance for carrying out the investigation than in the first series of the EMPA. Assessment Advisers reported few enquiries about this EMPA and the investigation appears to have worked well.

Centres are reminded that once the EMPA is known, candidates should not be given any resources or assistance other than what is identified as permissible in the Teachers' Notes.

The Mark Scheme made allowance for alternative, valid interpretations of questions. The commentary that follows focuses on the key ideas that were expected and whether candidates expressed those ideas and met expectations.

Task 1

Question 1

For most, this was an easy starter question but a few candidates confused hydrolysis with condensation. Weaker candidates suggested vaguely that 'substances' are broken down rather than molecules and a few did not include a reference to the requirement for water in this process.

Question 2

Most appreciated that a buffer is used to help maintain a constant pH but fewer could suggest that pH7 buffer would provide the optimum pH for the enzyme. Such candidates offered what they knew about the pH scale instead. Also appropriate, but only given by a few, was that using a pH7 buffer would mimic the conditions where lactase is found, or acts, in the body.

Question 3

The end of the test strip has an (immobilised) enzyme which reacts with glucose. There are no enzymes to continue the hydrolysis of lactose and removing the test strip from the solution effectively brings any hydrolysis to a halt. Appreciating that would have allowed more candidates to respond appropriately and explain that the test strip was wiped to remove excess glucose from the end of the strip, so as to avoid recording a false high concentration

of glucose; it also keeps the volume on the test strip the same each time. Few candidates achieved both marks in this question.

Question 4

This question required a *description* of what a tube used as a control would contain. It was envisaged that the majority of candidates would recognise the need to give both the contents and volumes of the contents in the tube. This did not prove to be the case. Total volume must remain the same, but this was often not considered. The Task identified this as an investigation based on the enzyme lactase, so the control should either eliminate the enzyme by replacing it with water, or use denatured enzyme. In either case, the same volume as in the experimental tube is required. This point is laboured because it was not clear to a large number of candidates and it was common to see the proposed 'control' tube containing both the active enzyme and its substrate, which was the same as the experimental tubes used. This all suggests that candidates would benefit from more practice with producing control experiments.

Question 5

The specification (Unit 3.3.3) identifies how candidates can be expected to process data. Calculation of rate is one expectation but few candidates could describe fully how they could use a graph to calculate rate, or where they had some idea, relate their knowledge to the graph in question. Quite a few appreciated the calculation would be based on the gradient of the curve. To describe this, many omitted to say that the calculation required recognition of the *change* in concentration divided by time; it was not simply any concentration divided by time. It was exceptional for candidates to state that they would either draw a straight line of best fit first, or use the rising straight part of a curve, as the region of the graph to read off appropriate values for their calculation of the rate.

Question 6

Candidates performed much better with this question using one of several appropriate ways to explain that colour is categorical, or qualitative, or that to plot a line graph numeric or quantitative data are required.

Task 2

Question 7 – presenting data (the table)

The investigation required a measurement of the glucose concentration in the milk samples before and after a two-minute interval. These measurements represented before and after treatment of milk samples with lactase. The type of milk, the independent variable, should appear in the first column and the concentrations of glucose in those samples, the dependent variable, recorded in the next column as before and after treatment and with repeat data shown. A few did not follow such a convention or produced separate tables for the two types of milk. The general trend expected was that Milk B (untreated) would show a higher glucose concentration after treatment with lactase, and that Milk A (lactose-free) would show little or no change in concentration. There were some curious results, such as glucose concentration recorded as lower rather than higher after lactase addition to untreated (normal) milk and the data shown by all candidates in one centre suggested that the milk samples had been incorrectly labelled.

To reiterate, the investigation enabled candidates to compare the glucose concentration of treated and untreated milks and to see how the addition of lactase affected said

concentration. Many candidates appeared to follow instructions blindly without spending some time appreciating the nature of the investigation. The only required calculation was that of mean values but some felt the need to 'do something else with the data'. Thus, many calculated the change in concentration or the rate of change in concentration. To achieve this, some decided they would measure glucose concentration every minute contrary to the instructions given in the method. The most successful candidates simply followed the method and recorded data as expected and without adding complexity.

Question 8 – processing data and the graph

As pointed out earlier, the only calculation required was that of mean values. The graph enabled a visualisation of glucose concentrations before and after treatment with lactase and allowed candidates to interpret which of the milk samples was the untreated milk and which was the lactose-free milk. Since milk samples were categoric, a bar chart was required. All but a few identified the type of graph correctly. Those who didn't attempted to produce a line graph but in doing so changed the independent variable, usually to time, further compromising the marks that could be attributed. The convention is that bars should be of equal width, as shown by most candidates, and that bars for different categories should not touch. It is acceptable if bars within a category touch and so, touching adjacent bars for 'before' and 'after' of milk samples was allowed. However, many candidates showed all four bars touching and failed to gain some credit as a result. Where candidates had plotted 'difference in concentration' or 'rate of change in concentration', credit was given where possible; as long as other conventions for axes, labels, units and scale were appropriate. Although not an expected feature of this investigation, it might be interesting for teachers to note the difficulty that candidates have when deciding on the units for a rate of reaction.

Written Test

Section A

Question 9

With the information provided, it was envisaged that most candidates would start the Written Test productively. Not all were successful and those who could not deduce what was on the end of the strip often listed everything they could think of. Many did correctly identify the presence of the two enzymes and the dye (of colour 1).

Lack of detail explained why full credit was not always achieved with the second part of the question. While many appreciated that Benedict's reagent reacted with all reducing sugars, few identified that lactose (or galactose) would also produce a positive result. This, again, reflects a lack of appreciation of what was involved in the investigation, where the earlier use of lactose should have provided a clue to answering this question.

Question 10

This question tested understanding of enzyme specificity and most candidates expressed their ideas clearly. A few believed an active site to be part of the structure of the substrate, or in this case, lactose. One point of caution, where a single letter is the only difference in the spelling of two words and where misspelling could completely change meaning, as with lactase and lactose, especial care should be taken with scientific terminology.

Question 11

It was pleasing to see that some candidates recognised the need to eliminate temperature as a potential variable. At a simpler level, most appreciated that leaving tubes in the water bath ensured that all reactants would be at the same temperature when mixed. Some assumed that the use of a water bath meant that the enzyme would be at its optimum temperature.

Question 12

The diagram showed the chemical formulae for the two components of lactose. The question stem reminded candidates that these components are released during hydrolysis. To reverse the reaction and remove water was a problem for a large number of candidates and a whole range of combinations of different numbers of atoms of the three elements were seen. For some, lactose would not even contain 12 carbon atoms.

Question 13

Candidates generally do better if they answer the question as asked and not attempt to answer the converse. Instead of explaining which sample was the 'lactose-free milk', many tried to explain which was not and invariably limited the mark they achieved. The identification of milk **A** was required. The initial presence of glucose demonstrated that lactase had already been added to this milk, digesting lactose within it into its components, glucose and galactose.

Question 14

The frequent crossing out in the table suggested quite a few candidates could not make up their mind or did not understand the context. Glucose is absent before treatment but present after treatment with lactase. Sterilised milk has been cooled following heat treatment and before the addition of the enzyme, information that some candidates appeared to ignore.

Question 15

Most identified the use of a water bath to prevent fluctuations in temperature, or the need for replicates to reduce the effect of anomalies as ways of improving the reliability of the results. In several cases, although an appropriate change in method was identified, the accompanying explanation was less than convincing.

Section B

In general, it is intended that resource material should not require a lot of reading time. However, it remains paramount that candidates get a feel for what the resources are about before they attempt questions in this section. Weak answers often reflected the failure to comprehend and use resource material effectively. Overall, examiners felt that candidates had performed a little better with the type of question in this section than hitherto.

Question 16

Most answers to this question were incomplete. While many understood that the presence of lactose in the gut would lower water potential, it was rare to see a clear explanation about why this would lead to watery faeces. Water either leaves surrounding cells to enter the gut or is not taken up by such cells. In this context, there was little or no reference to the role of cells and in most cases it was not clear where additional water had come from.

Question 17

This was a question where a better understanding of the resource material could have improved the mark achieved. Discomfort from bloating and pain is associated with drinking milk and discourages the intake of milk. There are few or no symptoms experienced with other types of food or when not drinking milk. This encourages the switch to more solid foods. Many suggested the discomfort arises from consuming lactose directly, ignoring the diet of infants.

Question 18

The simple course of action would be to remove foods containing lactose from the diet. This was recognised by the majority of candidates but less then explained that if symptoms abated, this would indicate that the patient was lactose intolerant, or that if the symptoms continued, this would indicate lactose tolerance. An alternative approach would be to test the faeces for the presence of lactose but very few candidates considered this as a course of action.

Question 19

Most candidates were able to name or describe the negative correlation. Similarly, the majority were able to identify African cattle herders and modern Europeans as the populations that had the greatest tolerance to milk or milk products.

Question 20

This question demonstrated the inability of many candidates to describe or explain a trend clearly and also showed that very many have difficulty in calculating percentage changes. It should have been clear that calcium intake increases to age 18 then falls. The form of expression frequently suggested that post-18 was old age and characterised by brittle bones. The explanation should have related to the role of calcium in the development of bones but that there was reduced bone growth after age 18. Many candidates used generalisations such as 'calcium is needed for growth' and did not gain credit. Calculation of percentage change continues to trouble many candidates and appears to be an aspect worthy of further attention.

Question 21

Understanding what the question required was vital. So many seemed to assume it would require a consideration of lactose intolerance whereas the evolution of lactose *tolerance* was what was asked. This required an understanding of both the process of evolution and also the resource material provided. Where the resource material had been understood and was used appropriately, candidates scored well. Such candidates recognised that, as a result of mutation, the lactase gene would not be switched off. Hence, humans keeping cattle and drinking milk could digest milk without discomfort and these people would have the advantage of little or no calcium deficiency. For some though, reference to calcium was omitted and the availability of lactose was thought to be the benefit.

UMS conversion calculator www.aqa.org.uk/umsconversion