



General Certificate of Education

Human Biology 1406

**HBI3X Externally Marked Practical
Assignment**

Report on the Examination

2009 examination - June series

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General

This was the first examination of a new component and a new approach to coursework which included the external marking of coursework. There was some difference evident in how candidates had been prepared, as well as how centres coped with administrative requirements. Centres are given advance notice of material and apparatus requirements. Assessment Advisers reported that a few centres had concerns about the difficulty of achieving results with the resazurin. In the event, there were limited problems but these related to the centre producing samples of milk with an adequate level of bacterial activity, the resazurin concentration was not an issue. Teachers should ensure that they understand what is required in the investigation and allow sufficient time to carry out trial investigations. In the light of this year's experience, further practical guidance will be offered in Teacher Notes for the next session.

Given that centres had advance notice, it was not appropriate for any centre to report a difficulty with providing apparatus which, in this investigation, only amounted to standard laboratory glassware and equipment. Centres are reminded that it is not permissible to provide candidates with data for the production of their table during Task 2. Candidates should record whatever data they obtain in a table of their own design. If they fail to collect any data, for whatever reason, some credit could still be possible for the design of the table. The centre has an obligation to ensure that the investigation will produce data with the materials they provide. In this respect, Assessment Advisers can provide advice if necessary.

Candidate Record Forms were often incomplete. Centres are reminded of the need to tick the box relating to the verification of practical skills. A failure to do so could result in all marks being withheld. Teacher signatures were sometimes missing. Candidate names and candidate numbers should be included at the top of *each* of the components. It would help examiners immensely if the Candidate Record Form, Task 1, Task 2 and the written paper were all held together by a treasury tag for each individual candidate. In a minority of centres the work of individual candidates was not collated, adding an unnecessary burden to the work of the examiner.

Task 1**Question 1**

A large proportion of candidates failed to recognise the need for regular checking as a part of monitoring temperature. Simply putting a thermometer in the water bath would not be sufficient to monitor temperature. The investigation was conducted at room temperature. Room temperature (and, thus, air temperature) is a potential variable. The use of a water bath, in this instance, would ensure that temperature did not become an additional variable in the investigation.

Question 2

Many candidates failed to use the information provided in the introduction. Sealing the tubes would prevent the entry of both bacteria and oxygen. Thus, any oxygen removed from the tube would be the result of bacteria already present in the milk. Few made the link between the use of oxygen and bacterial respiration.

Question 3

A suitable control could have been a sample of boiled milk with resazurin or water with resazurin. Those suggesting use of a sample of fresh milk or just resazurin showed a lack of appreciation of the use of a control. It was anticipated that the mixture would remain blue, the result of the experiment. 'Give the result' is not adequately met by the answer, "there was no change". This does not help a reader who is unfamiliar with the protocol. Either of the suitable controls would remain a blue colour but most failed to offer an explanation why. Better candidates appreciated that boiling would kill bacteria or there would be no change to the oxygen concentration to cause a change in colour from blue. Where different colours were achieved for an appropriate control, allowance was made for a correct explanation of the colour. Weak candidates suggested that bacteria would be denatured by heat, showing poor understanding of terminology.

Question 4

The mark scheme made allowance for different ways that an explanation might be offered, including both positive and negative approaches. In the event, many candidates did not reflect on the suitability of the method for determining *relative numbers* of bacteria in milk.

Question 5

Candidates were expected to identify that the data they were collecting were quantitative. The dependent variable was time (for the solution to turn pink) which was measurable and had units. A large number wrongly asserted that it was the colour of the solution, calling into question their understanding of the basis of the investigation.

A limited amount of light would be able to pass through a sample of milk placed in a colorimeter because milk is opaque. Some misunderstood the information and thought a colorimeter unsuitable for measuring the number of bacteria, which was not what the question asked.

Task 2 - the table

Guidance has been provided both in specimen material and launch meetings. Many candidates were clearly aware of what was expected but some individual candidates showing limited appreciation of conventions. Of more concern, it was sometimes the case that all candidates from a centre were unfamiliar with Institute of Biology conventions and produced totally haphazard presentations of their data. Even better prepared candidates showed a tendency to include units within the body of their table. This error was compounded where time was recorded in both minutes and seconds, rather than minutes and decimal parts of minutes. Only one unit for the variable should be used throughout the table (and subsequently on the graph). Centres are advised to reconsider how they approach the production of tables and whether there is a need to address a potential weakness before the assessment of a similar requirement at A2. Whilst not assessed as such, the inclusion of a title would be good practice. In the situation of incomplete column headings, the title might provide additional information to make credit possible.

To summarise, column headings should include a full description of the independent and dependent variables. In this investigation, 'temperature' was sufficient for the independent variable but 'time' was not enough to identify the dependent variable. 'Time taken to turn pink' would have been appropriate. The independent variable should be in the first *column* and not the top row. A column for 'tube number' offers no relevant information, is not required and should be discouraged. Units should appear only in the headings and not within the body of the table. Candidates should be encouraged to record time by a single unit. The use of either minutes *or* seconds would have been appropriate.

Task 2 – processing including the graph

One particular problem with mixing units for time arose with the calculation of the mean time taken. For example, the mean of 2:40 (i.e., 2 minutes 40 seconds), 2:45 and 2:50 is 2:45 but the mean as a decimal is actually 2.75 minutes. Many candidates compounded their initial error by plotting, as in this example, 2 minutes 45 seconds as if it was the decimal 2.45 on the scale they used on their graph. In general, graph drawing skills were mostly appropriate but a large number did not achieve full credit for a skill that must be repeated many times during an AS course. Weaknesses included not joining points, axes the wrong way, incomplete axis labels, an absence of units in the axis label, a poor line of best fit (where offered) and extrapolation beyond the plotted points. A common error was a non-linear scale on the x-axis. It was a concern that a large number of candidates were either not familiar with breaking the axis where values for the independent value do not start at zero, or did not appreciate that the axis does not have to start at zero. Further guidance can be found in the Institute of Biology's *Biological Nomenclature* publication as advised in the specification. As with the table, it is good practice to include a title. Again, this gives the potential for enabling credit where some aspect of labelling of the axes is incomplete.

Written Paper**Question 6**

This question was meant to get candidates to reflect on differences between their recorded values at a particular temperature. Few recognised that differences may be due to natural variation or experimental error or show the presence (or absence) of anomalies. Only a few appreciated that differences show that it is not appropriate to rely on a single reading or just the first reading. Many candidates did not interpret the question in this way and tried to explain the biology behind differences, or for no difference if that was the case.

Question 7

Milk of the worst quality would be from the temperature of the sample that turned pink the quickest. Many gave both the correct temperature from their results and the required explanation. A few candidates failed to obtain marks due to their inaccurate presentation of the temperature, which required units.

Many recognised that the use of 'poor' lacked a definition but few were aware that a standard or comparison would be required if the description was to be of any value. Several appropriate advantages of the description were identified including that it would be a readily understandable terminology for non-scientists and it offers the knowledge that such milk would contain many bacteria and would be unsuitable for consumption. Weak responses included a socio-economic analysis of the value of 'poor' milk which was not appropriate for the scientific context.

Question 8

Water at 10 °C is well below the temperature of a laboratory or the water out of a laboratory tap. Some candidates felt they would need a Bunsen burner to achieve such a temperature. Setting an electronic water bath at 10 °C would also not achieve this temperature. It would be necessary to add ice, but credit was also given where the use of refrigerated devices was suggested.

The specification requires candidates to be familiar with different types of graph. While good candidates recognised that the categorical data in the table would require a bar chart for presentation, a large number did not appear to be familiar with anything other than a line graph, which was the suggestion made. Some did offer a bar chart as the appropriate choice but were unable to explain why.

Many recognised that sterilised milk would remain a blue colour because the high temperatures used during the process of sterilisation would kill the bacteria. As in question 3, weaker candidates proposed that bacteria are denatured by heat. Few went on to explain that the blue colour remains because, the absence of respiring bacteria, no oxygen is removed and, hence, no colour change is caused. Many were able to give appropriate colours in the context of an investigation conducted at a higher temperature.

Question 9

Few candidates recognised that estimating the size of a bacterial population would be quicker than trying to count it. However, many appreciated that the resazurin test would only provide qualitative data.

Question 10

Most used the resource material appropriately to identify that the temperature or length of exposure was insufficient to kill all bacteria. However, this was not the case with part (b). Many did not appreciate the statement that “Some people believe it is *never* safe to drink untreated milk.” Those who did correctly identified farms where the numbers of bacteria in untreated and treated milk were similar.

Bacterial colonies can be seen by eye whereas a microscope would be required to see individual bacteria and there would probably still be too many to count. Weaker candidates thought that, since a colony would start from one bacterium, this would allow the calculation of the total number of bacteria present.

Question 11

Most recognised that it could be concluded that treatment 1 removed bacteria from teats but few could explain how it would act as a control experiment. Understanding the use of a control appears to be a particular weakness. There also appears to be a weakness with calculations. Most candidates just did a simple subtraction but this made no allowance for the different numbers of bacteria at the start and finish. They should have compared the proportional changes to identify that treatment 2 was more effective.

Question 12

Performance on the final question was disappointing, especially since an outline method was provided in the resource material. Few candidates recognised the need for a serial dilution or described the technique. Ultimately, having first identified the dilution which produces an appropriate number of colonies to count, the number of colonies counted is multiplied by the dilution factor. Credit for the majority was restricted to identifying some aspect of aseptic technique and the method of transferring a sample to the agar plate. It was pleasing to read an occasional comprehensive account but this was restricted to just a small number of centres.