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Human Biology HBI6X

(Specification 2405)

Unit 6: Externally Marked Practical Assignment

Report on the Examination

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General

This was the second examination of this component for the new specification. Examiners noted an improved performance with the statistical analysis in Task 2, and with the use of the Resources in Section B of the Written Test.

Assessment Advisers reported that few centres had experienced any difficulties with the investigation. This was anticipated given that the investigation itself was quite simple; it is what candidates are required to do with their data, and the questions that arise about the investigation, that determines the demand of the assessment. An issue for statistical analysis is the collection of sufficient data. On this occasion, this was met by providing candidates with a specific number of seeds (10) and instructing them to repeat the experiment, using all the seeds provided. This was not considered to be too demanding of time. It was expected that centres would trial the experiment and ensure that an adequate amount of time was available to candidates. In a small number of centres, it appears that this expectation was either not met, or candidates made their own choice, since all the candidates did not complete the task as instructed. This compromised their opportunity to reveal an overall trend in data as well as questioning the validity of the statistical analysis that followed. Centres are reminded of the need to trial an investigation.

The commentary that follows focuses on the key ideas that were expected for all questions and whether candidates met the expectations. It is still the case, as with AS, that many candidates spend insufficient time understanding what the investigation is about and this is reflected in the way that some questions are answered. It is also true that key words within a question are often not recognised, as shown by how candidates often address a question from the wrong direction.

Task 1

Overall, candidates tackled the questions in Task 1 more successfully than they did at AS. As might be expected, where there were weaknesses, they were exhibited by a smaller proportion of candidates.

Question 1

This question provides an example of how key words in a question are not acknowledged. Candidates were asked for 'one other piece of evidence' and thus, *evidence* was required. This should have been based on what candidates could see; soot on the tubes, light from the flame of the burning seed, steam from the water or smoke from the seed were all examples of evidence. No credit was available for restating that some unburned seed was left over since this was excluded by the question.

Question 2

By now, it would be expected that all candidates, and especially A2 candidates, could describe how to monitor temperature, but very many failed to achieve this mark. It is not sufficient to just simply place a thermometer in the tube, regular readings are required as well.

Question 3

What was thought to be straight forward question turned out to be a discriminator. From their experience of keeping the seed burning, it was not helpful to suggest keeping the burning seed under the tube for longer. It was more appropriate to refer to reducing the volume of water in the tube, or using a seed of greater mass.

Question 4

The majority appreciated the reagent and colour change required to show the presence of starch. A few suggested that Benedict's or Biuret reagent should be used and some candidates only referred to a colour change occurring, without giving the actual colour that would show starch was present.

Most candidates accurately calculated the proportion of the seed that did not burn as a percentage, although a few used a fraction to show the proportion. Where this was the case, the fraction was generally not reduced to its simplest form. Generally, candidates were successful with their calculations but some lost credit by only showing the proportion that *did* burn.

Question 5

While the majority realised that the time taken for the seed to burn was also required to calculate the rate of combustion, fewer appreciated that rate would be the product of change in seed mass divided by time. As was also found at AS, the calculation of a rate appears to be an area worthy of further attention.

Question 6

The simple response of many candidates was that the choice of units allowed the energy value of a food to be known. Better candidates appreciated that a common or standardised unit allows a comparison of the energy content of different foods, or that energy content is expressed in this way because the mass of food substances varies.

Task 2

Question 7 – presenting data (the table)

Table skills are also assessed at AS, so it was anticipated that candidates would be well prepared and this proved to be the case. Almost without fail, there were clear headings with the independent variable in the first column. Raw data on this occasion included the calculation of the energy content of each seed. Some failed to show both the mass and the energy content of each seed in the same table, thus demonstrating a lack of appreciation of what was being investigated in Task 2. It was not a requirement, but some candidates presented the mass of their seeds in sequence, from the largest to smallest mass. This reorganisation of data helped them recognise the overall trend more easily.

Question 8 – statistical analysis

Performance with this part of Task 2 was much improved and many centres are to be congratulated on how well their candidates were prepared for this aspect of the EMPA.

Candidates were better prepared for construction of a null hypothesis, giving reasons for their choice of test and the interpretation of the test statistic using the terms probability and chance. The use of these terms was directed in this Task but a few managed to ignore the requirement. In carrying out the statistical test, candidates are required to show their working. Although the use of a calculator or computer programme for the calculation only is permissible, this does not remove the need for candidates to show working. A printout of the calculation should have been attached to demonstrate that the candidate's data and test statistic were related. When constructing a null hypothesis where a correlation is suspected, it is generally better to propose that there is no association between the two identified variables. Proposing 'no difference' between the variables in this scenario usually changed the meaning from that required.

In this investigation either of the correlation coefficient (Pearson's) or the Spearman rank coefficient were acceptable tests to use but those choosing the latter found the calculation a little easier to complete.

Written Test

Section A

Question 9

Most candidates started the written test well, recognising that a graduated pipette would improve the accuracy of measurements.

Question 10

A weakness in expression was evident in this question along with some not very scientific answers, or suggestions of precautions against ineptitude. It was hoped that there would be recognition of the potential risks from expansion of water during heating, and that an angled tube would allow the flame to be in contact with more of the glass or water.

Question 11

The question identified that only some of the heat released from a burning seed was transferred into the water. If it was not all transferred into the water, it would have helped many had they considered where it was transferred to. Proposing the loss of some heat to "the environment" or "the surroundings" was a little vague. Transfer of heat into the glass of the tube, or to the air, or release in the light of the flame were some of the acceptable reasons offered.

Of all questions in the Written Test, part (b) of this question produced the most unsuccessful responses. The word 'or' was emboldened to direct candidates to give an answer supporting either accuracy *or* reliability. It was not uncommon that a response began "Yes…" and proceeded then to explain why both would be affected. Only a few candidates appreciated that reliability is affected, because the efficiency of the transfer of heat would not be constant, but would vary and not be the same each time.

Question 12

Candidates did not perform well with this calculation. A few chose to use the wrong set of data, whilst a significant number failed to recognise the need to calculate the energy transfer per gram. Their calculated value for mean energy transfer was of little use when this related to different masses and not a mean seed mass. The calculated values produced by the majority therefore offered no basis for comparison.

Question 13

Most appreciated that a scatter graph would be the correct type of graph to use. Rather fewer could explain their choice appropriately, although there were some good answers that demonstrated a complete understanding of data presentation including reference, in this example, to both variables being continuous, or exhibiting a correlation.

Question 14

A few candidates misread the question and provided a null hypothesis inappropriately relating mass and energy content, or they failed to state that there would be no difference in the <u>mean</u> masses of the seeds.

An explanation of how to use *t* tables was required. This should have included how to decide on the number of degrees of freedom, the probability level to use and how to interpret the test statistic against the table (critical) value. As seen before with statistics, candidates are better when using the student statistics sheets than when asked independently of these how to carry out, apply or explain statistical methods.

Question 15

Many candidates were not able to translate the concept of energy lost in faeces into an inability to digest all of the content of seeds. Thus, it was not surprising that relatively few identified the presence of indigestible cellulose in seeds. Exceptionally, a few candidates were aware that the absence of the enzyme cellulase would explain incomplete digestion.

Section B

Question 16

Few candidates achieved full credit with this question. The basic reasons were that loss of muscle tissue was not translated into a loss of cells, and fall in metabolic rate was not translated into less respiration. Given that the question asked about the fall in BMR, it was insufficient to only offer that there would be "less metabolic reactions". With both ideas put together, those that did understand achieved full credit by simply explaining that there would be fewer respiring cells.

Question 17

The hypotheses provided were not complex so it was difficult to appreciate why so many candidates wanted to offer complex interpretations over and above what was necessary and, as a result, make unclear suggestions. It was sufficient to suggest that men exercise less with age and that men eat less as the get older.

Question 18

Several suggestions were possible but, for full credit, an explanation of each suggestion was expected. The quality of the explanation usually provided discrimination between candidates with different abilities. It was common to see differences in surface area to volume ratio suggested. The majority of these answers demonstrated an appreciation that a higher ratio would result in greater heat loss. Conversely, few suggested genetic differences but those that did invariably could not suggest how a genetic difference might impact differently in the two men. The effect on hormone (testosterone) production, or different hormone levels would have been an appropriate suggestion.

Question 19

This type of question appears frequently in the context of how science works so it was surprising that few candidates provided complete explanations. A common unit allows comparison. This is important because, in this example, men and women are of different sizes. Although 'different sizes' could be expressed variously, it gave the basic idea. In most cases the response went no further than 'so as to compare men and women'.

Question 20

Given the amount of crossing out seen in the tables, there appeared to be a lot of changing of minds. It was generally the case that the altered version was not the correct version. Also seen among those that could not decide was the invention of new categories, such as 'medium' despite the direction to use specific resource material.

Question 21

Candidates who took time to assimilate all the information in the resources and get an overall appreciation of what was available, generally produced better responses than those who took the approach of "in resource A it says… and in resource B it says…". This question provided different ways to consider the information and the mark scheme made allowance for whichever approach was taken and if more than one approach was adopted.

One way was to look at the strengths and weaknesses of the data. For example, the nature of activity, age ranges and what constituted a 'suitable level' were not defined. There was no information given for women and no data for life expectancy to measure the belief against. Furthermore, what was believed was only based on hypotheses. Few candidates offered a detailed response based on this approach but those that did scored highly.

A different approach was related to the enjoyment of a longer life. A good response identified the benefits of maintaining an active lifestyle on the reduced risk of being overweight, becoming obese or developing diseases often associated with ageing, such as coronary heart disease and diabetes.

The approach of many though, was to identify issues associated with ageing, such as the tendency to be less active, lose muscle mass, increase fat stores and gain weight. The candidates producing higher scoring responses using this this approach also considered how BMR and weight were related and that control of weight gain was a strategy for maintaining BMR and providing the potential for a longer life. Weaker candidates took the view that if doctors believed it, then it must be true and little evaluation was offered.

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