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General Certificate of Education

Human Biology 1406

HBI3X Externally Marked Practical Assignment (EMPA)

Report on the Examination

2010 examination - June series

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General Comments

This was the second examination of this component for the new specification. Pleasingly on this occasion, the majority of centres recognised the administrative requirements. Thus, the PSV was ticked; Candidate Record Forms were signed by both teacher and candidate and the two Tasks and Written Test were all attached together per individual candidate. This helped the examiners enormously.

It was anticipated that there would be some improvement in the preparation of candidates for different aspects of the EMPA. This was true in part and detail will follow, but some of the weaknesses evident last year, with basic concepts like how monitoring is carried out, still exist. A key to improving performance is to ensure that candidates are fully conversant with HSW terminology and can give an explanation of the fundamental features of investigative work.

The Teachers' Notes contained further guidance for carrying out the investigation this year. Hopefully, this was the reason for the limited number of enquiries made to Assessment Advisers and the investigation appears to have worked well.

The mark scheme made allowance for interpretations to questions that could also be valid. However, the commentary that follows focuses on the key ideas that were expected and whether candidates met these expectations.

TASK 1

Question 1

Candidates need to appreciate that answers should directly respond to the question and be unambiguous. Thus, the root tip was held by its cut end not just to "stop damage to the root tip" but specifically to avoid damage to the cells undergoing mitosis. A large proportion of candidates gave the reason for use of toluidine blue as for staining cells rather than, specifically, the nucleus or chromosomes. Hydrochloric acid will macerate plant tissue but the specific term was not anticipated; descriptions of this idea were acceptable. Root tips were heated to increase kinetic energy and allow a faster effect for the acid. Some candidates just saw a reference to high temperature and launched into a discussion of enzyme activity without relevance to the investigation. Context is always important.

Question 2

Most appreciated that squashing would either spread out cells or help produce a single layer of cells. Not all appreciated that squashing between two slides would leave cells on both slides, either of which could then be used for viewing. Only a few candidates identified that different fields of view could be used from a single slide.

Question 3

The majority of candidates were able to calculate the mitotic index although a minority were apparently unconcerned that their calculated value was greater than 100%. It would seem to be a simple skill to consider whether a calculation looks right. The second part of the question required a consideration of the reliability of a calculation. Many did not use this as the basis for

their answer and considered genetic or environmental factors affecting the growth of the pea plant. Inaccurate identification of cells in mitosis, counting errors or lack of replicates were some of the possible reasons for doubting the reliability.

TASK 2

Question 4 - Presenting Data (the table)

In general, table construction improved but there were still a few centres where candidates did not follow Institute of Biology conventions. This clearly is an issue for such centres to address. In one way, the table was a little easier on this occasion because there were no units for either variable but a full description of each variable was required in the column heading. Although not a specific requirement, where a title was included, this sometimes provided further detail for an otherwise incomplete column heading. It is, therefore, good practice to provide a title for the table as this might help secure marks. With no PSA component within an EMPA, centres should appreciate that data collected can be used to reward the accuracy of experimental results. In this case, the data would show that most observed cells would be in interphase. Candidates should have identified the stage of mitosis or recorded a cell as in interphase. It did not help subsequent calculations if candidates did not assign all viewed cells in this way and probably betrayed some misunderstanding of the cell cycle. Thus, for quite a few, the collective number of cells in stages did not equal the total number of cells counted.

Question 5 – Processing Data and the graph

Candidates were provided with a formula for the processing of their data. The fraction of 720 minutes that each stage took to complete was to be calculated. Thus, the total for all stages would add up to 720 minutes but, as before, many candidates did not consider it worthwhile checking to see if this was true and if their calculations were therefore accurate. Errors are not penalised twice and the accurate plotting of a candidate's calculated values was allowed. There were cases where an axis label was incomplete. For some, the inclusion of a title (as with the table) provided additional information and allowed credit to be given. Given the size of some calculated values and difficulty of fitting these to a suitable scale, some tolerance was allowed with the accurate plotting of data but it was a serious error to break an axis *within* the chosen scale or add points beyond the top of the ruled lines on the graph paper.

The major weakness was a failure to recognise that the data were categoric and thus a line graph was not appropriate. Many did appreciate that a bar chart was required but were apparently unfamiliar with the requirement to separate the bars. Centres are reminded of the Institute of Biology publication identified in the specification. In essence, all bars must be of equal width and should not touch. For many, more practice with choosing the relevant type of graph and with drawing a bar chart would seem appropriate.

EMPA Written Test

Question 6

It may sound trite but candidates would really help themselves if they answered the question. The question did not mention plants, but rather than address why human tissue was not used, many candidates wanted to explain why plant tissues were used. Converse arguments can gain credit, where relevant, but there is usually a failure to gain full credit from such a strategy.

Simply, there are ethical issues with using human tissue. In addition, mitosis is not localised, cells can be difficult to obtain and invasive methods might be required. There is also the risk of infection or contamination of the sample.

Question 7

From the answers of many, there was a general failure to reconsider what the section looked like on the slide that had been used. Consequently many did not apply understanding. A few used diagrams to help but all that was required was the recognition that the root tip would be cut lengthwise.

Question 8

Although it was expected that most would respond with prophase, allowance was made for any stage of mitosis to be used where supported by the candidate's data. To account for the time taken, candidates were more familiar with what was happening during prophase than in any of the other stages. Again, many candidates apparently did not read the question. Despite the question stem naming the four stages of mitosis, many identified interphase as taking the longest, thus losing the opportunity of any marks for this question. It was evident here, and elsewhere, that not all candidates appreciate that the cell cycle is not synonymous with mitosis.

Many found the idea of uneven staining difficult to interpret. This also demonstrated a lack of appreciation of what the stain reacts with in the nucleus. The uneven staining was due to the uneven distribution of the DNA or chromosomes which take up the stain, in the nucleus. However, few were able to articulate this.

Question 9

"Yes, 75", a response seen, illustrates how candidates fail to read the question. In this case, a key word, *How*, has not been noticed and the answer given becomes meaningless. Having a representative or large enough sample or using all cells visible in the field of view was all that was required to demonstrate the number chosen had been thought about.

Question 10

Many candidates achieved full credit with an accurate completion of the table but, as with questions 3 and 5, there was a failure by some to check that the percentage equalled 100, or that the total time added up to 80 minutes. In this question the time for completion of mitosis, as opposed to the cell cycle, was given. It was surprising that so few candidates deduced the assumed length of interphase based on this method, or recognised that their method (invariably) produced a different time length for mitosis. It was a common feature that prophase was the longest stage in both cases and other similarities or differences in the stages of mitosis were allowed for, but references to interphase were irrelevant and continued to show a lack of understanding of what was being asked. Given this, it was not unexpected that most candidates did not identify the non-measurement of interphase as a factor affecting reliability. However, many appreciated one method used measurements as opposed to an assumption in the other.

Section B

Question 11

Some candidates can clearly recognise and describe similarities or differences coherently. Several possible responses were applicable but the most common answers referred to interphase as the longest stage in both cases, both types of cells spending least time in prophase and mitosis being quicker in cancer cells. The data were less well used to explain the rapid growth of the cancer. Those successful in this regard were able to explain that cancer cells produce more cells than healthy cells in the same time interval. The idea of per unit time was only given by the most able candidates. Few, therefore, recognised the need for this constant as an important factor for making any valid comparison.

Question 12

There were many good answers to this question. A starting point was to identify that blood flow would be less than normal. From this, many appreciated that this would reduce the availability of oxygen or nutrients resulting in the death of tumour cells. Poor responses did not make the starting point but ventured into different territory offering all that was known about cancer and not answering the question.

Question 13

Given that the drug damages healthy cells as well, doctors need to know what the lowest dose is that remains effective but without causing a patient harm beyond that deemed as tolerable. Overall, there was a generalisation about dose levels. Few were able to express the idea of a minimum dose level although the idea of needing a safe dose was given credit.

Question 14

Few candidates were able to make full use of the information available in Resource C. Responses to part (a) achieved little credit and it did not help where explanations considered changes *after* six hours. Candidates mostly described, as opposed to explained, the data. Recognising the need to describe or explain is a fundamental examination requirement and a weakness of candidates commonly reported by examiners. Answers to this question showed there was no exception here. Candidates, for the most part, just viewed the data without putting it in the context of mitosis or information provided earlier. If they had applied understanding, then it might have been recognised that more cells in metaphase could mean that metaphase was taking longer, or that fewer cells had moved on to anaphase, or that cells in prophase when the drug was given then moved into metaphase.

There were some better responses to the final question. These included reference to only one study or a lack of knowledge of dose level. The graph did not show an overall fall, recognised by many, but this did not stop weaker candidates suggesting that the drug was working well.