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Principal Examiner Feedback

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Pearson Edexcel IAL in Biology (WBI02) Paper 01 - Development, Plants and the Environment

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Overall impressions

There were some very good answers provided to the questions in this paper, indicating a sound grasp of the specification and accurate interpretation of questions. It was encouraging to see many students evidently taking into account the context of the questions. However, there will still many examples of students trying to fit learnt responses to questions; it makes sense that students learn from previous mark schemes in order to appreciate the type of responses required to gain high marks, but they must understand that the questions will not be the same from year to year, there are different contexts. A question about differential gene expression in one year, concerning the specialisation of pluripotent stem cells, will not require precisely the same answer as the question this year, on how a stem cell could give rise to genetically varied egg cells.

The data analysis questions asked students to determine relationships between variables presented in line graphs and in tables. Good answers were given by students who identified trends and patterns and supported these with relevant data, calculating differences where appropriate. However, these questions were not always answered well as a consequence of scales on graphs not being read accurately and by students who listed the points from graphs without any indication that they had analysed the data.

The question based on knowledge of the core practical on mineral ion deficiencies in plants, was either very well answered, or poorly answered. Students should be aware of the need to apply the skills developed through the core practicals to unfamiliar contexts, where procedures learnt have to be modified. Minute details concerning how plants are placed in test tubes are unlikely to gain credit, where the examiner is looking for ideas of how to apply methods to investigate the example provided. Good answers take into account the dependent, independent and controlled variables, and how these will be controlled or measured. Additional marks are often given for indications of how reliable data will be obtained.

It is essential that students appreciate the requirement to apply their knowledge and understanding of biology. Those students that did well in this paper achieved this by applying knowledge of various processes, from cell differentiation to natural selection.

Individual Questions

Questions 1(a)(i) to (iv)

The opening multiple choice questions provided a good test of the general knowledge of the differences between plant, animal and prokaryotic cells. The majority of students managed to answer at least three out of the four correctly.

Question 1(b)(i)

The majority of students correctly identified the diagram as the Golgi apparatus, although a common mistake seen was that some students believed it to be rough endoplasmic reticulum.

Question 1(b)(ii)

There were some very good answers, correctly referring to the modification of proteins, often with correct descriptions of the types of modification. Fewer students managed to accurately describe the packaging of the protein **in** vesicles, with many writing that the proteins were packaged **as** vesicles – just one word, but enough to change the meaning. Some students also gained marks for correct references to the production of secretory vesicles or lysosomes. However, there were many students that described the entire transport process of proteins from ribosomes all the way to secretory vesicles fusing with the cell surface membrane; this is a result of not reading the context of the question.

Question 2(a)

Many students knew the difference between tissues and organs, but many left out important details in their answers that lost them marks. It is important to note that tissues are composed of either **one** type of cell or **only** a **few** cell types, and that organs are composed of **many** tissues. Stating that tissues are made of cells and organs are made of tissues is not precise enough to achieve the mark at this level.

Question 2(b)

This question on the role of the cell cycle in tissue production generated many detailed answers describing the role of the cell cycle generally, often with details of the different stages of mitosis. Descriptions of mitosis were not required and did not gain marks. The context here is important and good answers referred to the increase in cell number, that these cells are **genetically** identical and that the cell cycle is involved in repairing damaged tissues by replacing cells. A common mistake was to describe the repair of damaged cells, instead of the replacement of these cells. References to asexual reproduction were irrelevant in the context of the actual question, but many students also mentioned this aspect of the cell cycle.

Questions 2(c)(i) and (ii)

These multiple choice questions tested knowledge of the stages of mitosis and were answered well, indicating a sound grasp of this aspect of the cell cycle.

Question 3(a)

This question used cloze procedure to test understanding of the structure of cellulose in cell walls. In these types of question, it is very important that students take into account the context of the words to be placed in the gaps. Many errors were made as a result of not reading ahead and checking that the word used made sense. It was pleasing to see many students refer to β-glucose and not just glucose, and many also correctly identified the correct roles for glycosidic and hydrogen bonds, many referring specifically to 1,4- glycosidic bonds. The last word was the most often incorrectly identified, with some putting in similar words such as 'microfibers'. Students do need to know that cellulose molecules are held together to form microfibrils.

Question 3(b)

The majority of students correctly identified cotton as the weakest fibre in the table, linking this to the lowest level of lignin. It is important that students recognise that 'low' or 'lower' are not enough when the 'lowest' or 'least' is required.

Question 3(c)(i)

Most candidates knew that calcium was needed in the synthesis of calcium pectate and that it was in the middle lamella. Some claimed that the ion provided strength on its own or in association with carbonate ions. Although some had the right idea about the microfibrils being held in place by the pectate, references to the pectate sticking the microfibrils together as a 'glue' did not accurately convey the idea of a matrix in which the microfibrils are embedded. Some also mistakenly linked calcium to cellulose or chlorophyll production.

Question 3(c)(ii)

This question required students to apply their knowledge of a core practical to an unfamiliar context. There were some very well thought out answers describing the independent variable – a range of calcium ion concentrations (as there was no means of students correctly suggesting suitable concentrations, any reference to at least five different concentrations was accepted); and variables to be controlled, including all of those on the mark scheme, such as light intensity, temperature, humidity, soil pH and concentration of other mineral ions (reference to nutrients was not accepted). Good answers also referred to either repeating the experiment at each calcium ion concentration or to obtain mean values. It has to be noted that examiners cannot give marks where students make statements such as 'calcium concentrations of 0.25%, 0.5% and so on'.

However, many students failed to correctly describe the dependent variable for this particular investigation – the grain yield, many referred to length of leaves. There were also irrelevant references to setting up a control with no calcium ions – this was inappropriate for an investigation to determine the optimum level of calcium ions for grain yield in wheat. There were also many overly detailed accounts of procedures for growing the plants, often in tissue culture, or on agar, that were not required. Unfortunately, many students lost marks due to describing an investigation into mineral ion deficiency rather than taking into account the context of the question.

Question 4(a)

The majority of students demonstrated a sound grasp of the principles of the double-blind trial. There were good descriptions of two **groups** of patients with migraine given either sumatriptan or a placebo with neither the patient nor the doctor knowing who had taken which. Fewer students gained marks for describing a variable to be considered within the group of patients selected – either large in size or controlled with regard to age or gender. Many did correctly describe the nature of the placebo.

Question 4(b)(i)

The majority correctly worked out the correct figure from the graph as 37% difference. Those who got the wrong answer often did so as a result of referring to the wrong lines on the graph.

Question 4(b)(ii)

This question asked for a description of the effect of sumatriptan on the symptoms of migraine. Good answers described the trends and patterns in the data, whereas others reiterated the data point by point. It must be emphasised that marks are not awarded for merely quoting data directly from either graphs or tables; there must be some element of analysis.

Many students noted that sumatriptan reduced the symptoms of migraine more effectively than the placebo and correctly calculated the 4% difference between the two concentrations of the drug after 120 minutes, or the difference between the drug and the placebo. Fewer referred to the fact that there was little difference between the two concentrations of the drug and even fewer noted that in the first 15 minutes there did not appear to be any difference between either concentration of the drug and the placebo. It appears that many students demonstrated a reluctance to state similarities between the two sets of data, instead looking for differences.

Many students lost marks as a result of ignoring the data for the placebo, however it is necessary to compare the performance of a drug with a placebo in order to determine its effectiveness.

Question 4(b)(iii)

This question asked students to suggest which *conclusions* could be drawn from the drug trial – this is distinct from question 4 (b)(iii). Many students did refer to the fact that some patients were free of symptoms having taken the placebo and not the drug and that the 10mg dose appears to be the most suitable.

However, many students provided answers that would have been better for Q4(b)(ii) as they were describing the effects rather than the conclusions.

Question 5(a)

Many students focused on measuring biodiversity without reference to the context of the question, which was 'how the effects of habitat loss on biodiversity could be measured'. There were many examples of learnt definitions of biodiversity, but few actually referred to recording the number of species over time in order to assess the impact of habitat loss. Descriptions of sampling techniques were also irrelevant in the context of the question.

Question 5(b)

This question asked for an **explanation** – not a description – of how seed banks conserve genetic diversity of plant species. As a consequence, many described the process by which seed banks conserved seeds, instead of referring to the collection of large numbers of seeds from a variety of plants of the same species, in order to ensure a large gene pool in the collection.

Question 5(c)(i)

This question asked for a description of the effects of drying time on the percentage germination of the seeds, as shown in the results table provided. Good answers referred to the trends and patterns in the data, correctly identifying that for seeds that had been stored after drying, the longer the drying time, the lower the percentage germination.

Incorrect references to positive correlation were sometimes used instead of the **negative correlation** shown in the data. Many students described the data for the seeds that were not stored, point by point, which was not creditworthy. There were some very good answers that referred to the overall trend, the fact that there was a large fall in germination for seeds dried for longer than 60 minutes and the fact that no seeds germinated when the seeds had been dried for 300 minutes.

Question 5(c)(ii)

This question asked for suggestions on how '**these** storage conditions' could be changed to increase germination success. The most common error made was for students to miss the context and not refer to the storage conditions actually described in the information provided – which were 22°C and 53% humidity. Therefore, answers describing low temperatures and humidity were not accepted, and neither were those describing other aspects of seed storage such as surface sterilisation.

Some students appeared to have misread the question and described suitable conditions for the germination of seeds rather than the storage of them. These errors in interpreting the question led to many students writing factually correct sentences that failed to answer the question. Good answers correctly referred to lower temperatures and lower humidity, with relevant descriptions of the effects of these on the growth of fungi and the activity of enzymes.

Question 6(a)

The majority of students correctly gave the answer as totipotency or pluripotency, although some described other properties of stem cells, such as the ability to divide, that did not address the context of the question.

Question 6(b)

This question tested students' understanding of the use of stem cells. The majority of students used the clues in the information provided to infer that the allele for brown fur was dominant, although some missed out on the mark by being too vague, such as stating that 'brown fur was dominant'. However, many then went on to describe monohybrid inheritance, without reference to the source of the brown alleles in the egg cells of the sterile white mouse. Good answers did explain that the brown fur alleles in the egg cells were present because the egg cells had been produced from stem cells taken from the brown mouse. The best answers were produced by those who took into account the context of the question, but these were unfortunately very rare.

Question 6(c)

This question asked for an **explanation** of how the structure of the egg cell is related to its function as a gamete, not just a description of the egg cell. The specification refers specifically to mammalian egg cells and this is the context in which the marks were awarded. Many students referred to the presence of haploid **nuclei** to allow the restoration of the diploid number of chromosomes after fertilisation. Many also referred to lipid droplets as energy stores – although there were also many references to lipid granules, confusing them with cortical granules. Many did go onto refer to cortical granules and better answers also referred to their involvement in the **thickening** of the zona pellucida (not the same as the production of a fertilisation membrane). Others described the acrosome reaction which was not relevant to the question. Again, the best answers came from students who applied their knowledge to the context of the question.

Question 6(d)

This question required descriptions of both differential gene expression **and** meiosis in order to explain how undifferentiated stem cells could give rise to genetically varied egg cells. The majority of students described one of these processes, but relatively few referred to both, which was necessary to score full marks in this question. Some lost marks due to imprecise descriptions of transcription **of DNA to produce mRNA,** and of the 'genes being used to produce protein', without reference to the translation of mRNA. Descriptions of crossing over and independent assortment also need to be precise with relevant references to chromatids for the former and chromosomes for the latter. There was evidence of students writing out learnt responses from previous questions on differential gene expression, starting with 'chemical stimuli' – it really is vital that students take into account the contexts of the questions and not just write out answers learnt for previous question papers.

Question 7(a)(i)

There were some excellent definitions provided for 'polygenic inheritance' indicating a sound grasp of this concept by many students. However, lack of precision did cost some students marks as they were vague when referring to 'many genes' – not referring to these being involved in the inheritance of a single characteristic. References to 'phenotype' were too vague in this context.

Question 7(a)(ii)

Most students correctly referred to continuous variation, although some described the types of variation in eggs, such as size and shape.

Question 7(a)(iii)

The majority of students correctly referred to either temperature or diet as environmental factors that would affect egg size. Only a few referred to incorrect factors such as genotype.

Question 7(b)(i)

Although many students correctly calculated the percentage increase in mean egg mass, but then lost marks due to incorrect rounding up of the figures. For example, 21.236 can be rounded up to 21.24 or 21.2, but **not** 21.3. Others made the common error of dividing the change in mass by the final mass instead of the original mass.

Question 7(b)(ii)

Many students just picked up on the fact that at 56 weeks, the Aseel hens laid more eggs than the Kadaknath hens. This was not sufficient to answer the question. Good answers referred to the fact that the Aseel hens laid more eggs at each time interval and that there was no overlap in the standard deviation values. Some mentioned the fact that the SD values were smaller for the Aseel hens, which applies to the reliability of the data, rather than the conclusion described in the question.

Question 7(b)(iii)

Good answers correctly described the trends and made relevant comparisons between the effects of age on egg laying for the two breeds. However, many answers lost marks due to inaccurate reading of the graph or references to approximate figures instead of accurate figures. There were also some students who used incorrect units to describe the age of the hens – varying from minutes to years.

The most common marks awarded were for references to neither breed laying eggs until 22 weeks, the percentages of each laying eggs being the same at 30 weeks and the optimum ages for egg laying for each breed. Many lost marks by writing generalised comments such as 'as age increases, so does egg laying up to a point, then it decreases again.' Another common error was to refer to the number of eggs instead of the percentage of hens laying eggs. There were many students who misread the scales on the graph and quoted incorrect values – this can be avoided with practice of graph analysis.

Question 8(a)(i)

This was a well answered question. Many students correctly stated the names of two types of adaptation, whereas many described the types of adaptations, such as eyespots on wings.

Question 8(a)(ii)

There were many very good descriptions of natural selection, with appropriate references to selection pressures and alleles, for beneficial features being passed on to the offspring, of those individuals that survive to reproduce. As this question tested clarity of expression, it was essential that references to key words in the process of natural selection were used correctly. A common misconception was evident in some students' responses, with statements along the lines that the selection pressure causes the mutation which leads to an advantageous adaptation, instead of mutations providing new alleles for features that were selected for by selection pressures. Additionally, there were also a large number of responses incorrectly referring to genes rather than alleles.

Question 8(b)

Good answers correctly described how phenotypes resulted from interactions between environmental and genetic factors. Many also noted that there could be differences in genotypes that could not be controlled. Many common incorrect responses to this question involved logistical reasons regarding the study of butterflies and were linked to different stages of the life cycle. Many students failed to refer to genotype at all.

Paper Summary

In order to improve their performance students should: -

- Read all of the details in the questions carefully, especially the context of the question.
- Ensure that the answer applies to the question being asked, with reference to the actual context.
- Take into account the 'command words', particularly 'describe' and 'explain' which require very different types of answers.
- Gain practice at interpreting information presented graphically and in tables.
- Take time to read graphs carefully, noting the scales used and the units.
- Try for shorter, more precise sentences. When sentences start to ramble on, it becomes difficult to determine where one point ends and another starts.
- Practice simple mathematical calculations – subtractions, and % differences, the commonest mistake is to divide the change in values by the final value instead of the original value.

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