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Examiners' Report/ Principal Examiner Feedback

January 2015

Pearson Edexcel International A Level in Biology (WBI02) Paper 01

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January 2015
Publications Code IA040374*

Overall Impressions

Overall, the students' responses for this paper demonstrated a relatively good standard of biological knowledge; particularly where answers were more straightforward. The standard of communication, however, continues to let students down. Where students exhibited poor communication skills it was not always clear exactly what they were referring to. Failure to read questions carefully and use the specific information presented on the question paper were evident; for example, command words such as 'explain' were often disregarded, resulting in responses that did not focus on the question. Students should also be encouraged to read all of the information provided in the introduction to the questions as this frequently contains facts vital to the correct answering of the question. It was promising to see many examples of students attempting to analyse the data provided instead of simply repeating mark schemes learnt from previous papers.

Individual Questions

Q1(a)(i) and (ii)

The majority of students correctly identified the chloroplast, although fewer were able to name the stroma as the area indicated by the label line.

Q1(b)

Although there were many examples of students scoring full marks for this question, many lost marks due to lack of specificity in their responses. Although the mark scheme did not penalise those who referred to 80S ribosomes, there was a requirement to describe the DNA within the mitochondrion and the chloroplast as being circular in nature. At this level students are expected to know which organelles possess a double membrane or envelope.

Q1(c)

When explaining why the presence of a chloroplast indicates that a cell is eukaryotic, it is not enough to simply state that only eukaryotic cells have chloroplasts – there must be some explanation that only eukaryotic cells possess membrane-bound organelles, or that prokaryotic cells do not contain membrane bound organelles.

There were many examples of students knowing the answer, yet failing to gain marks due to lack of precision in their responses. Even if a question is only worth one mark, care must be taken when answering to ensure that the mark can be awarded.

Q2(a)(i)

Although the vast majority of students gained this mark for correctly giving the sequence of organisation of cells, tissues and organs, it was not always referred to when answering the next sub section of this particular question. Early parts of the question often lead the students through the question and are relevant to following subsections.

Q2(a)(ii)

Students who read the question with care and related it to part 2(a)(i) were able to give good answers referring to the need to understand the effect of the drug on other tissues, or organs or organ systems. There were also many well written answers referring to the need to observe how the drug could be metabolised, absorbed or excreted.

Responses referring to the ethical issues did not gain credit, as the question did not ask why animals were used instead of humans, but why animal testing took place after testing on tissue samples. Descriptions of assessing toxicity of the drug were accepted, whereas reference to side effects was not allowed, as these are assessed when the drug is tested on human volunteers.

Q2(b)(i)

In three-phase testing, although drugs may be tested using a placebo in Phase 2, they are **always** compared to either a placebo or a pre-existing treatment in Phase 3.

Q2(b)(ii)

There was a wide range of responses provided to this question, with many correctly selecting 'age' and 'gender' as factors that needed to be taken into account when selecting volunteers for Phase 1 trials.

However, many repeated the information provided in the table by suggesting they all be 'healthy' – and whilst reference to health was allowed it had to be in the context of all having the same state of health or having a similar medical history. There were a number of incorrect references to consent and many examples of students writing several examples on each line where it was quite clear that only **two** variables had to be listed.

Q2(c)

There were some good examples of students following the instruction in the question and making comparisons between William Withering's trials and contemporary drug testing protocols.

However, it is important that the correct words be used when making comparisons, i.e. 'smaller' and 'larger' instead of just 'small' and 'large'. Many lost out on one mark by not making it clear that Withering's trials were **less** reliable, although the majority answered this question well.

Q3(a)(i)

Many students failed to gain marks for this question as they had not read the information provided. Underneath the photograph of the date palms there was the following sentence- 'Date palms are either female or male, but only the female plants produce fruits'. The question was set in the context of tissue culture and the production of large numbers of female plants.

Students were asked to explain how **only female date palms** could be produced using tissue culture techniques. Many described tissue culture techniques and gained no marks as the question was not asking for a description of those methods.

Some students described the process of differential gene expression being manipulated to produce date palms in which only the female genes were switched on, or even referred to somatic nuclear transfer to produce female plants – neither of which was correct.

The best answers were well written and stated clearly that the tissue or explant used for tissue culture was taken from a female plant and that asexual reproduction or cloning would give rise to plants that were all female.

Q3(a)(ii)

Most students correctly understood the question and described the need for pollination or fertilisation, although fewer linked this to the production of fruit by the date palms.

Q3(b)(i)

This question asked students to 'explain' how contamination of the explants was prevented. Many lost marks by just describing how this had been achieved by copying phrases directly from the table provided, such as 'surfaces of explants sterilised'.

In order to achieve marks for this question there had to be reference to these processes either killing the bacteria (or microorganisms) or preventing them from entering the containers in which the explants were grown. Those who did explain the purpose of stages 2 and 4 generally scored well.

Q3(b)(ii)

Most students grasped that contamination would not be beneficial to the plants, although they should be wary of making statements such as 'contamination may affect the growth of plants' which could be positive or negative so therefore not necessarily creditworthy.

Some students mentioned diseases in humans rather than in the plants being grown, which was not creditworthy. There was frequent reference to competition for food rather than nutrients or mineral ions. Vague answers were the main reason for full marks not being awarded for this question.

Q3(b)(iii)

Although poor expression did let some students down, most were able to make sensible conclusions about the patterns shown in the graph. However, some just stated the overall decrease from 0.3 mg dm^{-3} to 300.0 mg dm^{-3} without acknowledging what happened in between those two concentrations.

A significant proportion of students also lost marks due to just quoting figures from the table, rather than describing the trends. Manipulation of the data that was carried out by many students was correctly done and there were a lot of high scoring responses to this question.

Q3(c)

Many students approached this question as if it was asking for a description of the cell cycle rather than an explanation of its role in tissue culture – a very specific application of knowledge.

Good responses did refer to the increase in the number of cells brought about by mitosis. Those who mentioned mitosis amongst a list of the stages of the cell cycle did not gain credit as there had to be an indication that it was linked to an increase in cell number. Very few identified the increase in cell size during the G1 and G2 phases, which is relevant to this question.

Q4(a)(i)

This was answered well by those who took the time to study the line on the graph with care and then described the main increase in mean mass of oranges from 0.00 to 0.10 kg of magnesium nitrate, followed by no change between 0.10 and 0.20 kg.

Marks were lost carelessly by students who failed to describe the different stages precisely, e.g. 'after 0.1 kg …' is too vague on its own. Some also referred to the speed of growth, e.g. 'the oranges grew slower after 0.2kg', which is not creditworthy as there is no time element within the data provided. This is a common error made by students when describing lines on graphs, inaccurately referring to a slight increase in mass as a slow increase.

Q4(a)(ii)

Although working out a percentage change is a standard calculation, and not particularly demanding, a surprising number of students failed to answer this question correctly. Many misread the question, failing to note the fact that they were being asked to calculate the **maximum** percentage increase in total mass of oranges produced. As a consequence they selected the wrong figures from the graph.

Many identified the correct figures but then either divided the lowest mass by the highest mass, or the difference by the highest mass. Practice is required to ensure that students can carry out basic calculations of this nature.

Q4(a)(ii)

Although many students appeared to have understood the question, they found it difficult to provide logical, systematic answers. Very few noted the fact that there were only four points on each graph and that smaller intervals could have provided a more accurate point for the optimum concentration. There were not many answers that stated that the optimum could have been 0.1 and 0.2 kg or from 0.2 to 0.3 kg, although many did refer to the fact that the graph for **4(a)(i)** suggested an optimum of 0.3 kg. There were also quite a few answers that incorrectly referred to other factors that had not been controlled, despite the clear instruction 'Using the information in both graphs…', showing yet again the importance of reading instructions with care.

Q4(b)

A significant number of students appeared to have no idea why plants needed magnesium and nitrate ions. Many were able to describe what the function of these ions were in plants but found it more difficult to explain how they could increase the yield of oranges. However, there were quite a few that referred to 'chloroplast' instead of 'chlorophyll' and many did not make the next link to increased photosynthesis and therefore greater yield of oranges.

There were also those who seemed to believe that nitrates contain amino acids, failing to grasp the fact that nitrates are required for the production of amino acids. For full marks, it was necessary to make the link between increased photosynthesis or increased amino acid production with increased growth and hence higher yields.

Q4(c)

This was another example of a question clearly asking for just **two** separate answers, in this case reasons that plants need water. Yet again, many students seem intent on writing a list on each line available. It is strongly advisable to write just **two** answers when only **two** answers are requested. There was also a significant minority that interpreted the question as asking why sandy soils need extra water, probably due to skim-reading the question instead of taking the time to read it carefully.

Q5(a)(i)

Vague descriptions of tissues as 'groups of cells carrying out a function' gained no credit. There was a requirement for a clear indication that the groups of cells are all similar or from common origins. There also had to be a clear description of these cells working together for a common function. There were plenty of good answers showing that many students had learnt accurate definitions of the terms used in the specification.

Q5(a)(ii)

A wide range of plant tissues was referred to, including parenchyma and collenchyma which are **not** on the specification. There are only **two** plant tissues referred to in the specification which need to be recognisable and they are xylem and sclerenchyma. About half of the students taking this paper did pick up on the clues in the labelled diagram, noting the thickened secondary cell wall and correctly identifying the tissue as sclerenchyma. Spelling was, on the whole, close enough in all cases to award the mark where the correct answer was provided.

Q5(a)(iii)

The majority correctly identified this layer as the middle lamella.

Q5(b)(i)

Many did correctly refer to both cellulose and lignin for full marks. However, some misread the question, did not acknowledge the word 'substances' and therefore referred to tissues or cells, such as xylem, instead of substances.

Q5(b)(ii)

Many did manage to achieve full marks for reference to cellulose microfibrils and pectin, although there were a lot of responses that were not well written and indicated some confusion surrounding the arrangement of microfibrils in the primary and secondary cell walls. The structure of the cell wall is an area of the specification that is not clearly understood by many students.

Q6(a)

Many students managed to produce more than a standard definition of endemism and actually answered the question by referring specifically to the two species of penguin in the question. Others failed to gain credit as they did not refer to either the emperor penguin or Galapagos penguin.

Q6(b)

Many correctly identified the anatomical adaptation as the smaller surface area to volume ratio – although all three alternatives were selected by a significant number of students.

Q6(c)(i) and (ii)

Less than half of the students answering **6(c)(i)** correctly picked D as the correct position on the phylogeny diagram for the emperor penguin. An understanding of these diagrams is necessary in order to interpret them correctly. However, a greater proportion did answer **6(c)(ii)** correctly identifying the position of the species of penguin most closely related to the Galapagos penguin.

Q6(c)(iii)

Although many students had an idea that molecular phylogeny could involve the study of DNA or proteins, fewer were able to describe what was studied or to state that the more similarities there were, the more closely related the species. Many responses stated that these molecules could be studied to determine the level of closeness, in a sense just repeating the question.

There were many responses that were too vague, referring to the comparison of genes of DNA, without referring to the sequence of bases in DNA or amino acids in proteins. There were some good answers referring to DNA profiling and the analysis of similarities to determine the closeness of the evolutionary relationship, with a clear indication that more similarities, the greater the closeness – thereby not just repeating the question.

Q6(d)

There were many responses to this question that missed out on full marks due to lack of precision. The question required reference to the penguins in particular and not just a standard description of the process of natural selection. Many achieved marks for describing geographical isolation and a relevant selection pressure. Marks were also gained for reference to individuals with advantageous characteristics surviving to breed.

However, lack of reference to alleles, or incorrect reference to genes, cost many students the remaining marks.

It has to be emphasised to students that it is the possession of particular **alleles** rather than **genes** that enables them to evolve and become better adapted for their environment; all the individuals of a species possess the same genes, but it is the presence of different alleles that brings about the variation within populations.

On the whole, the majority of students have a good understanding of the process but fail to describe it clearly. This was a QWC (Quality of written communication) question that focused on clarity of expression – hence the need to be absolutely clear when describing the process involved.

Q7(a)

It was evident that many students read no further than the phrase 'breeding programmes' and approached this question as if they had just been asked to describe anything to do with breeding programmes in zoos with relation to the giant panda.

Unfortunately, this failed to gain many marks as the emphasis was on the way in which breeding programmes allowed the conservation of genetic diversity in the species. Therefore references to IVF, surrogate mothers, reintroduction programmes and protection from predators gained no credit.

There were good answers referring to the use of stud books, exchange of animals or gametes between zoos, and the need to avoid inbreeding. Some answers were along the right lines with descriptions of limiting the mating of pandas with the same mate, however, reference to avoiding the mating of close relatives was often missing. This was a relatively straightforward question, but failure to read the question carefully yet again resulted in the loss of marks.

Q7(b)(i)

Many students were thrown by the context of the question and resorted to just describing the function of mitochondria in the sperm cell without going on to describe why damage would affect the ability of the sperm to fertilise an egg.

Good answers did refer to respiration in the mitochondria providing energy, and that damage would result in less energy and therefore less movement of the flagellum.

Q7(b)(ii)

Like **7(b)(i)**, the context of a damaged acrosome membrane proved difficult for some students. Many clearly understood the function of the acrosome, although there were also many who did think that the acrosome fused with the egg cell membrane and allowed the sperm to enter the egg. Some attempted to describe the acrosome reaction and others tried to make this question about the cortical reaction instead.

Good answers clearly understood that the acrosome contained digestive enzymes and that damage would prevent the acrosome membrane from fusing with the cell surface membrane of the sperm, which in turn would prevent the release of those enzymes by exocytosis and therefore mean that the sperm would be unable to digest a pathway through the zona pellucida. Poor spelling of key words cost marks here as this was a QWC question testing the accuracy of spelling of technical terminology.

In general, students need to be able to apply their knowledge rather than just recall it if they wish to score high marks in all questions.

Q8(a)

This question asked for the two trends from the graph to be described. Many answers were very vague, referring to smoking generally being associated with lung cancer, rather than to an increase in the number of cigarettes or years of smoking being associated with an increased risk of lung cancer. There were also a number of students that misread the graph as referring to the ages of people rather than to years of smoking. In addition there were some odd descriptions of the number of cigarettes being drunk rather than smoked, but these were ignored. Some students also identified points that did not fit the overall trends and these were credited, although descriptions of points from the graph were otherwise not awarded marks.

Q8(b)

Many misread the question and described causes of cancer instead of explaining what the statement in the question suggested about the causes of cancer. The correct answer should have just stated that there must be a genetic cause of lung cancer. There was no evidence in that statement that lung cancer has both genetic and environmental causes, only that there is a genetic factor involved.

Q8(c)(i)

Although many students were on the right lines, no credit was given for reference to identical twins having the same 'DNA', 'genes', 'genetic material' etc – these phrases are all far too imprecise and are not sufficient to gain credit at this level. There were also references to identical twins being genetically 'similar', which were again not creditworthy. However, many did accurately refer to identical twins having the same genotype. Well written responses went on to describe that as identical twins have the same genotypes, any differences in phenotype would be due to environmental factors.

Q8(c)(ii)

This question proved to discriminate very well. The most common correct response referred to the identical twins showing a greater concordance of lung cancer, whilst some misinterpreted this as greater incidence of lung cancer. Many students did manage to infer that the evidence proved that lung cancer had both a genetic and environmental component.

The very best answers correctly described the concordance values as being so low that it would appear that the greater contribution is from environmental causes. There were also some very good answers that referred to the fact that if the cause was solely genetic there should be 100% concordance between identical twins and as there is not, there must also be an environmental cause. Although this question was not easy, there was information provided within the question leading up to 8(c)(ii) that would have helped students deduce reasonable answers.

Paper Summary

In order to improve their performance students should:-

- Read all of the details in the questions carefully and double check the context of the question, do not 'skim read' - make sure to read every word. Answer the question being asked, with reference to the actual context.

- Develop a familiarity with the terminology encountered at this level and learn how to define key phrases accurately.

- Try for shorter, more precise sentences. When sentences start to ramble on, it becomes difficult to determine where one point ends and another starts.

- When underlining key words in a question, try to refer to them when writing the response.

- Gain practice at interpreting information presented graphically and in tables.

- Practice simple mathematical calculations – subtractions, and % differences.

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