Examiners' Report
Principal Examiner Feedback

October 2020

Pearson Edexcel International Advanced Level

In Biology (WBI15)

Paper 01 Respiration, Internal Environment, Coordination and Gene Technology

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Introduction

Candidates were able to demonstrate their knowledge and understanding by tackling the wide range of questions offered in this paper. It was clear that many of the candidates had studied the pre-release article and were able to relate their reading to the questions asked in a meaningful way. There were very few blank spaces, indicating that students found the questions accessible. Some students attempted to “set the scene” before beginning their actual response, often merely repeating the words in the question. Irrelevant writing wastes time and gains no credit. Incorrect interpretation of the wording of some questions was less evident this year as was difficulty in applying candidates' knowledge to unfamiliar scenarios that were presented.

It is evident that candidates would benefit from a clearer appreciation, understanding and expectations of the command words used in the questions.

There were some straightforward questions that yielded high marks across the board and some more challenging questions that discriminated well.

The simple mathematical tasks were done well, but multi-part and more challenging mathematical questions often proved problematic. Conversion of units seemed to present a significant problem to many candidates.

Overall, the level of knowledge demonstrated was very satisfying for a new specification.

Question 1b(iii)
This question asked students to describe the role of chemiosmosis in the synthesis of ATP. This was a direct recall question from the specification. Many very good responses were given here by the majority of candidates. Most candidates started with NAD and FAD and continued logically through the whole process of chemiosmosis. Weaker responses often only gave part of the required mark point, e.g. mp3 electrons pass along the electron transfer chain, without reference to energy. There were many vague references to stalked particles.

Also, many candidates omitted ‘space’ for mp4 stating merely inter membrane.

A key point was that ATPase was often stated rather than the correct ATPsynthase.

Question 2(b)
This question asked students to explain how ultrafiltration removes urea from the blood. This question proved straightforward for most candidates. MP1 was generally seen. It was pleasing to see that many candidates understood how the high blood pressure was caused and could explain it succinctly. Mp3 was generally seen less and should be a focus of teaching.

Question 2(c)
This question gave students data comparing the kangaroo rat and the brown rat. This data had to be used to deduce why the kangaroo rat is more successful than the brown rat at living in desert habitats. Surprisingly the first mp was very rarely stated. Most responses started with the kangaroo rat producing more concentrated urine. A good understanding was shown about the need to actively transport Sodium ions into the medulla. Several responses were seen where sodium was stated rather than sodium ions. Furthermore, most candidates recognised that there were more mitochondria but failed to state that this was to produce more ATP. Several stated that it was to produce more energy – this is not acceptable at A level. Many candidates were aware of Sodium ions but not in the context of active transport.

Question 3a(ii)
This question provided a graph showing the effect of MDMA on the ADH levels in the blood over a 24-hour period. Students were asked to calculate the rate of removal of ADH from the blood between 4 and 8 hours. This question was either answered very well or very poorly, with few intermediate responses. Many candidates failed to read the correct values from the y axis often being out by a factor of 10. They had clearly used the MDMA axis rather than the ADH axis. Where the gradient was successfully calculated a common error was to use the units from the MDMA axis rather than the correct pmol dm^{-3}. To achieve mp2 the appropriate units had to be given. Perhaps practice of graphs using multiple axes might benefit candidates.

Question 3(b)
This was a level-based question, where students were asked to comment on the role of ADH in MDMA-induced brain swelling. The question specifically asked the candidates to use the information in the graph and the table as well as from candidates own knowledge to comment on the role of ADH and MDMA in brain swelling. Most candidates knew the effect of ADH on water uptake by the kidney with many good responses explaining clearly the way aquaporins worked. There were many candidates which did not use any information from the graph or table. This often limited them to Level 1. Only a significant minority of candidates explained how the brain became swollen correctly. A few candidates thought increased volume of blood gave increased blood pressure which pushed water into the brain from the capillaries rather than explaining it in terms of osmosis and lower sodium ion concentration in the blood. Very few level 3 responses were seen as clear linkage to knowledge was often missing.

Question 4(b)
This was a mathematically based question where students had to use the results in the table to calculate the difference in resting heart rate between the two groups. This calculation was done well by the majority of candidates. The most frequent error was to fail to convert correctly from cm^3 to dm^3. However even with this error 2 mps could be obtained through ECF. To obtain mp3 a correct number to 2 decimal places **with** units was required.

Question 4(c)
This was a level-based question. The question specifically asked the candidates to use the information in the graph **and** the table as well as from candidates own knowledge to explain the role of the heart in responding to regular exercise.

A significant number of candidates knew how the heart responded to regular exercise but did not use any information from either table. This limited them to Level 1 irrespective how detailed their explanation of the way the heart responded and the biology behind that. A very few candidates showed the information from the table and detailed explanation with logic and linkage to attain Level 3. There were however many good Level 2 responses.

Many candidates gave detailed explanations of the myogenic control of heart rate.

Question 5(aii)
This question provided students with a table of results for an investigation showing the effects of two different lights sources on the mean pupil diameter in the eye. The majority of candidates were able to find the area of the pupil. However, though they were given the value of pi many used the value on their calculators. The big issue for this was question was the conversion of mm^2 to m^2. This meant that mp2 was frequently not achieved. Many were out by a factor or 10, 100 or even 1000.

Question 5(aiii)
This question required students to describe how light entering the eye causes the pupil to respond. The responses were very varied. Many candidates did not read the question carefully as they gave detailed explanations of the way light affects the eye from a biochemical viewpoint including hyperpolarisation, bipolar cell and impulse along optic nerve. There were many good responses along the lines of mps 1, 3 and 4. Few details of a reflex arc were seen. In mp3 many omitted 'in the iris'. Most students who attempted mp4 gave the order of relaxing and contracting correctly.

Question 5(bi)
This was a direct recall question from the specification where students had to state the meaning of 'pluripotent stem cell'. This question was generally done well. There are still too many candidates who state that pluripotent stem cells can give rise to all cell types even though this point has been referred to in previous exam reports.

Question 5(bii)
In this question students had to suggest why the epithelial layer was checked to ensure that there were no stem cells present before it is was placed in the eye of the patient. Again, this question was done well. Students had few problems gaining credit here.

Question 6(b)
In this question, students had to describe the role of ion transport in maintaining the resting potential of a neurone. This question proved to be problematic to many candidates. This was mainly due to a lack of detail and precision in their responses. In mp1, candidates needed to state active transport' rather than pumped. Mp 2 was achieved by the majority of candidates for the direction of movement of the sodium and potassium. Several responses did not state that the potassium ions were diffusing 'out of the axon'. Mp5 was often inferred but not clearly stated.

This question discriminated well.

Many students gave descriptions which confused the terms axon, neurone, cell, and membrane.

Question 6(c)
Students were given a graph showing the effect of the neurotoxin TTX on the nerve impulse of an axon. Many candidates did not interpret the graph precisely, so their absolute deductions were incorrect, e.g. for mp3. Many stated no depolarisation rather than correctly stating reducing depolarisation. Mp1 did not present a problem to students but in mp2 many did not give the direction of sodium ion diffusion. In mp4, many just stated no action potential rather than the full explanation required for the mp.

Question 7(aii)
In this question, students were asked to explain why the release of reduced quantities of dopamine by pre-synoptic neurones could result in motor symptoms. Students generally provided complete responses to this question. Where marks were not awarded it was generally because students were incorrectly recalling details of the process. Again, where absolute answers were given, e.g. no action potentials, rather than fewer action potentials, no credit was given. Most students accessed mps 1 and 2.

Question 7(b)
In this question, students were required to suggest how the release of dopamine from pre-synoptic neurones could be inhibited. Several students did not gain mp1 as they did not state where the Calcium ions moved into. Many students could explain that there was no fusion of vesicles with the pre-synaptic membrane. There were many encouraging suggestions here.

Question 7(c)
In this question, students were required to describe how microarrays and bioinformatics could be used to investigate the genetic basis of Parkinson's disease. Many candidates found this question quite difficult. Only mp4 was seen with any regularity. Students understand what bioinformatics is used for and could give a clear description. However, the understanding of the use of microarrays is much weaker and only the strongest students could apply the process to the situation provided in the question. Many have a clear idea of how microarrays are used, but not in relation to the question. As such mps 2, 3, 4 and 6 were rarely seen.

Question 8(a)
Students showed a good knowledge of the nature of this term although only the strongest candidates continued to score mp2 by making reference to changes in the base sequence of the DNA.

Question 8(b)
In this question, candidates were required to explain why 'tumours…..riddled with different mutations' are good candidates for immunotherapies. This question was challenging with many candidates discussing the nature of the immune response rather than the specifics demanded by the question. Most students did not refer to the effect of mutations on membrane proteins. As such mps1 and 2 were rarely seen. Some students made reference to proteins being recognised as antigens but few stated 'when presented on antigen presenting cells. Mps 4 and 5 were seen and candidates had a good knowledge of an immune response and the production of T killer cell leading to the destruction of more cancer cells. It seemed that many responses were from stock answers from previous questions on the immune response, rather than on the specifics required from the article.

Question 8(c)
In this question students had to explain why a CT scan was used to show that Judy Perkins was free of tumours. Many students showed a good knowledge of CT scans and that they use X-rays. However, several missed mp1 as they did not refer to the production of an image. Only a few students made correct reference to the density difference between the tumour and body tissue.

Question 8(d)
In this question students had to explain why a checkpoint inhibitor was given with the lymphocytes in the immunotherapy used to treat Judy Perkins. Most students did not refer to information given that checkpoints are a type of protein that prevent the activation of immune cells, and these are produced by the cancer cells so immune cells are inhibited. Hence the cancer grows. Students found this question challenging as many could not appreciate that the checkpoint inhibitors stop the checkpoint proteins, produced by cancer cells, from blocking immune cell activation. However, mps 2 and 3 were seen on a frequent basis. Again, many students showed a good knowledge of the immune response but did not relate their knowledge directly to the question.

Question 8(e)
In this question, students had to explain how 'a gene variant' that produces a defective form of an enzyme' reduces the effectiveness of clopidogrel. The majority of candidates made a pleasing attempt at this question. However, many students simply stated that mutation led to production of a polypeptide with a different primary structure. They did not start the story at the gene variant having an altered DNA base sequence. Most students got mps3 and 4. Some students gave generic responses from past questions without directly referring to clopidogrel.

Question 8(f)
In this question, students had to suggest why blood vessels are required to form functioning spinal cord tissue. Students frequently stated mps 3 and 4 but omitted the idea of capillaries allowing mass transport to overcome the limitations of diffusion (mps1 and 2).

Question 8(g)
In this question, students were required to suggest how a 'brew of growth factors and other proteins' can stimulate induced pluripotent stem cells to produce a functioning tissue. Most candidates found this last question accessible. There were no blank responses suggesting candidates had ample time. Mps 2,3 and 4 were by far the most common responses. The idea of growth factors / proteins binding to receptors was rarely stated. Weaker students focused on the key words 'growth factors' and treated as it was a plant growth factor stimulating growth and development.

Overall Summary

Based on their performance on this paper, students are offered the following advice:

- Look closely at the number of marks allocated to each question and equate this to the number of ideas or points presented.

- Use precise, scientific terminology of an A level standard.

- Read the stem of the question closely before committing an answer to paper.

- Understand that simply repeating the stem is unlikely to gain any credit.

- Show workings in calculation questions to avoid losing marks.

- Greater accuracy is needed where conversion of units is required as part of the response.

- Understand that the command word 'explain' requires a biological rationale in the answer and not simply a description.

- Show how data has been manipulated where required instead of simply quoting figures from a graph or table.

- In level-based questions where table/graphs are provided, the response should use the information in the table / graph together with own knowledge to provide an answer.

- Have a better appreciation of the expectations of the command words used in the question.

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