Examiners' Report
Principal Examiner Feedback

January 2021

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 range of questions offered in this paper. It was clear that many of candidates had studied the pre-release article and were able to relate their reading to the questions asked in a meaningful way.

Towards the end of the paper there were some blank responses, possibly indicating that time management was an issue with this paper. Some students attempted to “set the scene” before beginning their actual response, often merely repeating the words in the actual question. Irrelevant writing wastes time and gains no credit.

It is again 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, e.g. percentage difference, but multi - part and more challenging mathematical questions often proved problematic. This was highlighted by the lack of response to the equation $y=mx+c$. Conversion of units did not appear to be a problem in this paper.

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

Question 1b

This question asked students to explain why ATP was required in maintaining the resting potential. This was a direct recall question from the specification. The majority of students correctly related the use of ATP to sodium – potassium pump. However, the weaker students merely couched their response in terms of energy. Many responses referred to the movement of sodium ions and potassium ions across the cell membrane / axon. Few students clearly explained that this movement of sodium and potassium ions was to establish concentration gradients.

Question 2a

This was a calculation-based question on a bar chart showing results of training on the strength and cross-sectional area of muscle. The graph was very clear, and most students were able to identify the correct percentage from the graph. This led to increase in strength being correctly calculated. However, several students failed to give the answer to 3 significant figures.

Question 2b(i)

This was a question based on a table comparing muscle fibres before and after training. They were told that intermediate fibres were structurally between slow and fast fibres. Students were asked to describe how the structure of the intermediate fibre would differ from a slow twitch fibre. This question was generally well answered with many students gaining full marks. Inexplicitly several responses compared slow and fast twitch fibres. There was an expectation that the response should be comparative – less, fewer, more, or higher.

Question 2b(ii)

This question was based on the table showing the effect of training on muscle fibres and students had to comment on the effect of exercise on this muscle. Most students identified that training increases both muscle strength and cross-sectional area, together with there was no effect on slow twitch fibres. Few students identified from the table that there had been a decrease in fast twitch fibres and an increase intermediate fibres so fast twitch fibres had been switched to intermediate fibres as a result of training. Furthermore, the greater the exercise the greater the switch from fast to intermediate fibres.

Question 3a

This question was based on a diagram of a human brain. Students had to complete a table naming region and giving an appropriate function of the region. It is a direct recall question from the specification. The majority of responses obtained full marks here. Again, there was confusion between cerebellum and cerebrum in weaker responses. Also, some suggestions for functions were too vague, e.g. reflex actions, hormones.

Question 3b(ii)

This question was about how positron emission tomography (PET) could be used to identify the part of the brain that was affected by a seizure. This question proved to be challenging to many students. They seemed to lack confidence in this particular procedure. Responses lacked accuracy and detail and seemed to be confused with other techniques, e.g. fMRI

Many students used isotopes in the place of glucose. Although quite a few related the brain being overactive to needing an increased supply of glucose or neurones with increased respiration. Hardly any responses detailed how positrons emitted produce gamma rays that are detected and are converted to an image. This should be a focus for learning.

Question 3c

This question was about seizures which result in an increased body temperature. Students had to suggest how this might occur. Very few responses started from the idea of impulse / electrical activity from the neurones at the site of the seizure. Many commented on the thermoregulatory centre in the hypothalamus. A few students only referred to the hypothalamus. The majority of students came up with a suitable description of an event that would lead to increased body temperature.

Question 4b

This was a level-based question. The question specifically asked the candidates to use the information in the diagram **and** the table as well as from candidates own knowledge to comment on the defects in the ETC in the individuals with mitochondrial disease.

A significant number of candidates knew details about the electron transport chain but did not use any information from either table or diagram. This limited them as to get level 1 students needed to refer to the individuals even if only as a description / comparison of the results. Very few candidates showed the information from the table, diagram and detailed explanation with logic and linkage to attain Level 3. There were however many good Level 2 responses gaining 3 or 4 marks, which directly explained where the defect occurred matched to a particular individual.

Majority of students were level 1 or level 2 on this new style level-based question.

Question 5a

In this question students had to explain why mutations in the RPE65 gene, which converts trans-retinal to cis-retinal can result in blindness. The majority of students explained how a mutation would result in a change of enzyme structure, but then failed to relate this to RPE65. It was almost a stock response. Most candidates stated that ci-retinal and rhodopsin cannot be regenerated/reformed. Hardly any students finished their responses by stating that the rod cells would not have any photoreceptor – hence blindness ensued.

Question 5b

This question was about the results of an investigation using doses of gene therapy and the effect on the quantity of trans-retinal, cis-retinal and the ability to follow a path. The results were shown as bar charts with respective error bars. Students had to describe the conclusions that could be made from this investigation. Most students stated that increasing dose of gene therapy gave increased ability to follow a path. Many gave that increasing dose increased cis -retinal. However, a common error was that students referred to individual doses and the effects of these individual doses rather than overall conclusions. Reference to error bars where linked to a specific graph was generally accurate.

Question 5c

In this question, students had to describe how mutations in other genes which could cause blindness could be identified. The majority of students were aware of the use of microarrays and went further to explain the process in detail. This is encouraging as microarrays are a new topic to this specification. However, in this question complete details of the process were not required. A comment on identifying genes that were actively transcribed was needed. A further process involved sequencing the genome of individuals with inherited blindness and comparing with large numbers of individuals with or without blindness to identify the mutations. Several students were aware of key words but not in the context of the mutations causing blindness.

Question 6a

This was a mathematical based question where students had to use the results of exercise on the cardiac output for a fit and unfit person and calculate the percentage decrease in heart rate over a 120 second period. Their answer was needed to an appropriate number of decimal places – given that the unfit % was given as 16% their answers could similar or to one decimal place. This question was well answered.

Question 6b

This was another mathematical question where students had to calculate the heart rate of an unfit person at 5 mins. They were given the equation for a linear relationship, y=mx+c. This is a higher-level maths expectation which proved problematic to many students. The answer for the heart rate was expected to be a whole number. A few students who were able to manipulate the equation gave heart rate as a decimal, e.g. 108.75

Question 6c

This question was asking students to explain the difference in time it would take for the fit and unfit person to recover from the exercise. The responses here were very varied with many being couched in the vaguest of terms. The majority of students were related to a fit person having a greater cardiac output although several merely commented on stroke volume. Incomplete responses were the main reason for not getting the mark, e.g. several students commented on greater transport of oxygen but either referred to lungs or by heart and did not refer to muscles. A comparative rate was required for a comment on the reduction in oxygen debt / lactate. Many students referred to an unfit person having more anaerobic respiration hence more lactate, or the converse for the fit person.

Question 6d

In this question students had to describe how heart rate is controlled in response to changes in the blood following exercise. This question confused many students who describe what would happen to the heart rate during exercise. The target of this question was about after exercise with the pH in blood increases causing impulses being sent via the parasympathetic nerve causing a slowing of the SAN. Most students however were aware of the cardiovascular control centre in the medulla and that pH changes in the blood were detected either by chemoreceptors or by the cardiovascular control centre. So even if students took the question the wrong way, they obtained 2/4 marks.

Question 7a(i)

This question was in the context of Parkinson’s disease. Students were asked to describe how a neurotransmitter transmits a nerve impulse across a synapse. The majority of students showed very good knowledge about this process although in some their responses lacked precise details which meant they failed to achieve all of the marking points. Students had a clear image of calcium ions diffusing into the membrane but failed to make reference to the calcium ion channels opening when the impulse arrived at the pre-synaptic knob. Students clearly were aware of the neurotransmitter being released into the synaptic cleft and binding to receptors on the post synaptic membrane, leading to the opening of sodium ion channels. Many missed referring to depolarising the membrane but stated initiating the action potential.

Again, there was some confusion between the terms axon, cell membrane, neurone, synapse and synaptic cleft

This question discriminated well, with a full range of marks seen.

Question 7a(ii)

In this question students needed to describe how L-Dopa reduces the symptoms of Parkinson’s disease. The majority of students could describe that L-Dopa crosses the blood brain barrier and once inside the brain it was converted to dopamine. However, many students then merely stated that this reduced the symptoms of the disease without specifically referring to the effect on muscle action / tremors. Reducing symptoms of Parkinson’s disease gained no credit as it was in the stem of the question.

Question 7b(i)

Students were asked to explain how transcription factors are involved in the synthesis of dopamine, in this question. Students had a good knowledge of transcription factors but often failed to put their answer in the context of gene(s) for the synthesis of dopamine. Most students stated mRNA synthesis but most then continued that this is then translated into dopamine rather that the translation into an enzyme which was then used to synthesise dopamine.

Question 7b(ii)

This question was based on the results of an investigation comparing people without Parkinson’s disease with those with Parkinson’s disease caused by unknown factors or a mutation LRRK2. The results were shown in bar chart form with respective error bars. This question discriminated well, showing a full range of marks.

Students showed that in the main they understood the data from the graphs although often they used the number of dendrites separately to the length of dendrites. It sometimes needed some piecing together to access the marking point. The strongest students showed a real understanding and appreciation of error bars and could explain the relevant meaning in context.

Question 8a

In this question students were asked to explain how the Ebola virus can cause internal bleeding. Most were able to state that the virus replicates in the endothelial cell, which was given in the stem of the question, and clearly stated that eventually cell lysis occurs as the virus breaks out. However clear explanation as to why internal bleeding occurred were much rarer. Few students were clear that the damage to the endothelial cells caused gaps in the capillary walls leading to loss of blood. Too many gave a general reference to artery/vein/blood vessel.

Question 8b

In this question students had to explain how the immune system learns how to make antibodies. This question was well answered by the majority of students. They showed a good understanding of the process in chronological order. However, the main way that students did not reach the marking points was imprecision in naming the key cells involved in the process of making antibodies, e.g. T helper cells called T cells. The function of B cells was well stated. This question is direct recall from the specification and has appeared in several recent papers in one guise or another.

Question 8c

This question required the students to explain why flushing with water released the vaccine from the filter. Some students got the idea that sugar dissolved in the water but did not mention release of the vaccine or that vaccine molecules dissolved in the water also. No responses referred to the sugar molecules being bonded to the vaccine molecules by hydrogen bonds as the starting premise for their answer.

Question 8d

In this question students had to explain how a vaccine produced using a virus replicating in eggs may become less effective. Many students recognised that as the virus replicates mutations may occur. However, few related the fact that more mutations would lead to a greater number of changes in the amino acid sequence of the virus coat proteins which would mean that as the immune response is specific, antibodies will not be produced against the Ebola virus.

Question 8e(i)

In this question students had to describe how insect cells could be genetically modified to produce antigens for an Ebola vaccine. This question was well answered having been in recent papers in some form or another. Some students had clearly visited or learned the previous mark scheme as they gave a stock response but not in the context of the question, namely Ebola virus antigen. Appropriate vectors named were plasmids, bacterial or viral vectors and liposomes. Suitable descriptions of the techniques for putting the vector into insect cells included micro-injection, gene-gun and heat shock.

Question 8e(ii)

In this question students had to suggest benefits of using an insect cell to produce the Ebola virus antigen. This was surprisingly poorly completed with vague and often generic responses that had come from similar previous questions. A noticeably large number of students focused on being safer although inexplicably several kept referring to the Ebola bacterium. A common error was to state that insect cells do not suffer mutations. Too absolute and incorrect.

Question 8f

In this question students had to suggest why the stems of different versions of haemagglutinin molecules are the same, but the heads can be different. There were many blank responses here possibly because students had run out of time. However, students found this question particularly challenging. Many suggested that mutations occurred but in the heads of the haemagglutinin molecules rather than in the DNA or nucleic acid. Only the strongest students obtained any credit here.

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 and do not merely repeat sections from the stem as the answer as it would gain no credit.
- Show workings in calculation questions to gain some credit even if the final answer is incorrect.
- 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.
- Where a conclusion is asked for from a table of results or a graph look for an overall conclusion rather than specific conclusions at moments in time within the results.
- In level-based questions where table/diagrams are provided, the response should use the information in the table / diagram together with own knowledge to provide an answer.
- Higher level maths skills need to formally practise prior to the examination.
- Have a better appreciation of the expectations of the command words used in the question.

Given this is only the second time that this specification has been examined students are becoming more aware of the demands and expectations within the exam and all should be congratulated on the progress being made.

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