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Examiners' Report/ Principal Examiner Feedback

January 2015

Pearson Edexcel International A Level in Biology (WBI05) Paper 01

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General Points

Candidates were able to demonstrate their knowledge and understanding by tackling the wide range of questions offered in this paper. It was clear that the vast majority of 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 attempt 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.

Incorrect interpretation of the wording of some questions was evident as was difficulty in applying candidates' knowledge to unfamiliar scenarios that were presented. Overall, the level of knowledge demonstrated was very satisfying.

Question 1 (a)

This question was a simple multiple choice item to ease the candidates into the paper. Answers were mostly correct which was pleasing.

Question 1 (b)

This question provided several additional multiple choice items to continue to ease the candidates into the paper. Again, answers were mostly correct which was pleasing. The item that posed greatest difficulty was (b)(i) where many candidates wrongly chose A as their answer.

Question 1 (c) (i)

In this question, candidates were expected to look at the table of data and describe the effect of IAA concentration on the mean increase in stem length. The majority appreciated that the data shows an increased elongation as IAA concentration increases but only the better candidates gained both marks by also recognising that in dish 2 at a concentration of 0.01 mg dm^{-3} there was a slight decrease.

Question 1 (c) (ii)

The vast majority of candidates were able to name a variable that needed to be controlled in the experiment. The most common correct answers were temperature and species of plant used to obtain the coleoptiles.

Question 1 (c) (iii)

The majority of candidates identified dish 4 and also offered an acceptable reason, such as it was the dish in which the mean increase in stem length had the greatest range.

Question 2 (a) (i)

This question expected candidates to use the trace to calculate the volume of oxygen consumed per minute. Many candidates found this task difficult to accomplish and the examiners sensed that many candidates had little experience of using spirometers. The examiners accepted any answer within the range 0.40 to 0.42 dm^3.

Question 2 (a) (ii)

The calculation challenged many students. Students who gave the wrong answer in (a) (i) could still gain one mark in this question provided they showed in their working that they had multiplied their wrongly calculated volume by 60 and then divided that answer by 70. The examiners awarded two marks for correct answer within the range of 0.34 to 0.36 even if no working was provided. Nevertheless, we would always encourage candidates to show their working.

Question 2 (a) (iii)

Candidates struggled to express their answers and often failed to make it clear if they were referring to a trace obtained at rest or a trace obtained during exercise. The examiners rewarded candidates who appreciated that the trace obtained during exercise would have more peaks per minute, each peak to trough showing a greater tidal volume and the slope of oxygen consumption would be steeper.

Question 2 (b) (i)

Candidates were asked to name the carbon dioxide absorber used in a spirometer. Most recalled this was soda lime, though credit was also given for sodium hydroxide and potassium hydroxide. Weaker candidates incorrectly named hydrogen carbonate indicator, lime water or silica gel.

Question 2 (b) (ii)

Candidates struggled to explain how a trace at rest would differ from the one obtained during exercise. The examiners rewarded those candidates who appreciated that the trace at rest would not show a downward slope, because the volume of oxygen consumed would be offset by the volume of carbon dioxide in exhaled air. Candidates could also gain two marks if they appreciated that there would be an increase in the concentration of carbon dioxide inhaled, which would increase the breathing rate, which would result in an increase in the tidal volumes shown on the trace. Many candidates struggled to express their ideas in an erudite manner, and many believed there would be a volume increase because of the accumulation of carbon dioxide and oxygen within the spirometer. Only 13.2% of candidates obtained both marks.

Question 2 (c)

This question was well-answered with 51.6% of candidates gaining full marks. Candidates are clearly comfortable in recalling how carbon dioxide is involved with the control of breathing rate. Examiners rewarded students for making it clear that an increase of carbon dioxide in the blood would lower the pH of the blood which would be detected by named chemoreceptors. Impulses would then be sent to the ventilation centre and then to the muscles involved in ventilation. Weaker candidates wrote about the cardiovascular centre and heart rate.

Question 3 (a) (i)

This multiple choice question was well-answered with most candidates recalling that the part labelled T represents the node of Ranvier.

Question 3 (a) (ii)

This multiple choice question was more challenging, but most candidates were able to recall that depolarisation is taking place at 0.75 ms on the graph.

Question 3 (a) (iii)

In this question most candidates were able to demonstrate that myelination allows saltatory conduction to take place and that this increases conduction velocity.

Question 3 (b) (i)

This was a challenging question with only 10.5 % of candidates gaining full marks. These candidates demonstrated excellent knowledge and understanding of the role played by sodium ion channels in the transmission of nerve impulses. They appreciated that the poison would stop the transmission of impulses because opened sodium ion channels would allow sodium ions to diffuse into the axon down a concentration gradient, permanently depolarising the membrane making it impossible to establish a resting potential. Weaker candidates merely wrote about how nerve impulses are normally transmitted, failing to address the question asked.

Question 3 (b) (ii)

This was a challenging question that expected candidates to suggest a sensible biological explanation for the fact that the neurones of the frog are not affected if they come into contact with the poison. The better candidates were rewarded for sensible biological ideas such as the channel protein in frog neurones being different so that the poison cannot bind, or that the poison is metabolised in the body of the frog. That said, most candidates did struggle and many answers discussed habituation or made irrelevant references to Schwann cells and myelin sheaths.

Question 4 (a)

Most candidates were able to interpret the information in the graph to offer an acceptable response. 50.7% gained all three marks usually by stating that the risk of death decreases with increasing exercise and that there is a greater decrease in older people. Other correct responses often seen were that in the younger people the risk of death remains constant after 70 arbitrary units of exercise, and that the risk of death is the same for both old and young people at 80 arbitrary units of exercise.

Question 4 (b) (i)

Most candidates appreciated that exercise decreases the risk of diabetes and obesity.

Question 4 (b) (ii)

The examiners rewarded candidates who made it clear that the effect of exercise on the immune system depends on the level of intensity. So, an answer that stated that exercise improves immunity or reduces immunity gained no credit. Candidates should know that intense exercise can cause immune suppression, but answers that made it clear that low levels of exercise also impede immunity or that moderate exercise improves immunity were also credited.

Question 4 (c) (i)

The question discriminated well and it was pleasing to note that 23.0% gained full marks and 14.6% gained five marks. The events that take place in cells during anaerobic respiration to ensure an ATP supply are clearly understood by the better candidates who made pleasing references to glycolysis, phosphorylation of glucose, the role of NAD and NADH, pyruvate formation and its conversion to lactate. Many also appreciated that there is a net gain of two ATP molecules per glucose molecule.

Question 4 (c) (ii)

This question also discriminated well and there were many answers that named lactate as the culprit in angina and also offered a sensible biological reason, such as the effect that a lowering in pH would have on enzymes. Very few made reference to the stimulation of pain receptors.

Question 5 (a) (i)

Most candidates were able to interpret the graph to state that venom A is more toxic than venom B and to offer an acceptable reason, such as venom A kills the same percentage at a lower dose than venom B. A note of caution to those candidates who write sensibly about the trends but then leave it to the examiner to decipher which venom is most toxic. These candidates need to be made aware that examiners are not allowed to decipher on behalf of the candidates. It is the responsibility of the candidate to state clearly which venom is the most toxic.

Question 5 (a) (ii)

The vast majority of candidates appreciated that the dose of venom represented the independent variable.

Question 5 (b)

This question challenged candidates and only the 22.2% correctly identified *P. Bahiensis* as having the most toxic venom. Candidates clearly struggle to convert mg into µg, or vice versa.

Question 5 (c)

Candidates scored poorly in this question. The examiners suspect that the reason was that candidates rushed into writing all they know about the role of calcium ions at a synapse, or all they know about nerve impulse transmission, failing to address the actual question despite having been told that cramps are constant muscle contractions. As such, candidates are encouraged to carefully read all the detail provided in questions. This question stated that constant impulses were occurring, so answers that discussed action potentials or the role of calcium ions at synapses were not rewarded.

The question asked required students to explain why constant impulses result in constant muscle contraction (cramps), and required discussion of the release of calcium ions from the sarcoplasmic reticulum, which would bind to troponin and have an effect on other muscle proteins involved in contraction. Many candidates wrote about constant contraction reducing ATP levels which results in anaerobic respiration with the production of lactic acid.

Question 6 (a) (i)

This question examined knowledge of events that occur in the electron transport chain. The examiners were surprised by the number of candidates who struggled with this question - only 31.2% gained full marks. The correct answers of oxidised NAD, oxygen and water were seen, but many answers contained puzzling references to ATP and NADPH.

Question 6 (a) (ii)

This multiple choice question allowed 60.0% of candidates to show that they understood the role of the inner mitochondrial membrane.

Question 6 (b)

This was a challenging question but 30.9% of candidates gained at least two marks by appreciating that inhibition of cytochrome oxidase would stop the manufacture of ATP because electron transport along the electron transport chain would be prevented. The better candidates also appreciated that the reduced carrier could not be oxidised or that electrons could not be passed

to oxygen to make water. They also made references to oxidative phosphorylation and to the fact that the only source of ATP would be from glycolysis. Those that appreciated that muscle contraction would be prevented sometimes lost this marking point by not naming a suitable muscle.

Question 7 (a)

The scientific article was about animal testing. This part was reasonably well-answered, with 54.8% of candidates able to recall from the article a non-animal alternative that is used in research. The better candidates also appreciated that there would be a reduction in the use of animals or a reduction in harm to animals.

Question 7 (b)

This question required candidates to recall reasons why medicines are tested on animals before they can be tested on humans. The examiners rewarded answers that made it clear that the testing protocol enabled the efficacy of the medicine to be measured and helped to analyse its safety and dosage. A pleasing 44.0% of candidates were able to recall one reason and 43.7% gained both marks.

Question 7 (c)

This question was one of the most challenging on the paper with only 9.0% gaining full marks. The most common correct responses made reference to mRNA synthesis and protein synthesis. Better answers also mentioned the role of transcription factors and RNA polymerase binding to promoter regions. There were occasional references to suercoiling and repressor molecules.

Question 7 (d)

A pleasing 45.2% of candidates gained one mark usually by making reference to the homogenous nature of 'knock out' mice and the better candidates also appreciated that the function of one gene can be investigated. Credit was also given if candidates appreciated that a larger sample size could be used and that drugs can be used with these mice that cannot be used in humans.

Question 7 (e)

The vast majority of candidates understood that the use of thalidomide during pregnancy would have improved the experimental design when testing with this drug.

Question 7 (f)

Most candidates were able to offer an acceptable definition that made it clear they understood the term genome. The mark was often lost when it

was not apparent in the answer that reference to all the genetic material was being made.

Question 7 (g)

This question expected candidates to appreciate that the polio vaccine had to be tested on animals because it needed to be tested in living nerve tissue which would be dangerous if used on humans because the vaccine contained a virus that could revert to virulence. Most candidates were able to appreciate at least one of these two ideas and a pleasing 21.0% gained both marks.

Question 7 (h)

The examiners were surprised that this question posed difficulty for many candidates. The idea of selection is one that A level candidates should be familiar with but only 30.0% gained full marks. The most common correct responses made reference to mutations allowing resistant organisms to survive. Some candidates lost credit because they believe that the drug causes the mutation. The better candidates also made reference to the fact that the resistant allele would be passed on to offspring and that the frequency of the resistant allele would increase.

Question 7 (i)

Questions on ethics are always challenging usually because they demand a high level of written expression. Examiners rewarded candidates who made it clear that absolutism is an ethical position which argues that it is always acceptable to use animals regardless of suffering or argues that it is never acceptable to se animals regardless of the possible benefits.

Question 7 (j)

A pleasing number of 51.3% of candidates appreciated that the ethical position of relativism would argue that there are circumstances when animals could be used in experiments providing there is benefit to be gained.

Question 7 (k)

This question expected candidates to offer an explanation as to why reducing sample size could produce results that are not meaningful. Many appreciated that a small sample size would generate unreliable and invalid results which would reduce confidence in any conclusion. There were also many answers that made pleasing reference to the lack of data available for valid statistical analysis.

Question 7 (l)

The examiners were surprised that only 22.7% of candidates obtained full marks as this question examined a topic that A level candidates will have

experienced at GCSE and AS level. The marks were awarded to candidates who made reference to the role of restriction enzymes and the insertion of the functional gene into cells using a named vector.

Question 7 (m)

This question examined knowledge and understanding of the work carried out by Hubel and Weisel to investigate brain development. It seems apparent that the work of these scientists is not fully understood as only 7.3% of candidates gained full marks and only 9.9% gained four marks. Most candidates appreciated that the work involved the closing of eyes but few went on to develop their answers to include reference to the visual cortex, ocular (not ocular) columns, a critical window, neural connections and the loss of synapses.

Questions at the end of a paper are most at risk of not being attempted as some candidates run out of time but the examiners wondered if blank spaces in this question were a result of lack of time or lack of knowledge.

This paper gave candidates the opportunity to demonstrate their knowledge and understanding; their ability to apply their knowledge to unfamiliar scenarios; and their ability to draw together links between different areas of the specification.

In order to avoid common pitfalls in future papers it would be helpful to:

- Look at the number of marks allocated to each question and try to make sure that answers at least equate in terms of the number of ideas presented
- Use precise, scientific terminology that reflects A level study
- Appreciate that repeating the stem of a question or sentences from the passage is unlikely to be rewarded
- Be relevant with longer prose answers. This will help avoid wasting time which could be of value with the more difficult analytical questions
- Read the stem of a question carefully before committing to paper
- Appreciate that some questions will expect knowledge of AS work to be examined
- In calculation questions, show your working, to avoid losing all the marks for a simple mathematical error

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