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Examiners' Report/ Principal Examiner Feedback

January 2014

IAL Biology

Unit: WBI05_01

Energy, Exercise and Coordination

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Grade Boundaries

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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 signs that some students ran out of time judging back the blank spaces left in the latter question parts. These students could help themselves by not "setting the scene" before beginning their actual response in other questions. Irrelevant writing wastes time and gains no credit. Incorrect interpretation of the wording of some questions continues to be somewhat evident, as does the difficulty in applying candidates' knowledge to unfamiliar scenarios presented. However, overall, the level of knowledge demonstrated was very satisfying.

Question 1 (a)
This question provided several multiple choice items to ease the candidates into the paper. Answers were mostly correct which was pleasing. The item that posed greatest difficulty was (iii).

Question 1 (b)
Most candidates appreciated that tendons attach muscle to bone but many failed to gain additional credit by making reference to the fact that inelasticity means they do not stretch when a muscle contracts which allows the bone to be moved. Students should think about what inelastic means – that is, it does not stretch, and then consider why this is important when muscles contract in an attempt to move the bone. Carelessness cost marks as shown with statements such as, "muscles contract to move muscles".

Some candidates wrote about ligaments and their answers gained no credit. Candidates are encouraged to look at the number of marks allocated and include at least an equivalent number of ideas in their responses.

Question 2 (a) (i)
There were many muddled responses and many candidates complicated their answers by writing in irrelevant detail. A simple answer stating that a transcription factor is "a protein that switches on a gene" would have gained all the marks on the mark scheme.

Question 2 (a) (ii)
The processes involved were well known, and most candidates gained some credit, often by making reference to restriction and ligase enzymes. Most knew that a gene was involved but many failed to say it was removed from DNA, and many gave details of the polymerase chain reaction which was not required. A surprising number thought that a bacterium would act as a vector.

Question 2 (b)
There were many sensible suggestions linked to the words "risk to other organisms" in the stem of the question. Answers that made references that could not be interpreted as risky were not credited.

Question 2 (c) (i)
Candidates struggled with this question, often quoting data from the table with showing no understanding of what it meant. Stating that the lowest temperature mean is 9.2 for the GM fish with the gene for red protein and 5.3 for the non-GM fish is not answering the question. Examiners could only reward candidates who understood the consequence of this temperature difference to survival in cold water.

Question 2 (c) (ii)
Some candidates had difficulty giving an interpretation of the statistical data and others failed to note that they had to consider only the unmodified zebrafish and those with the gene for green protein. A number of candidates stated that, as the SD was the same for both genes this meant there was no difference in the lowest temperature. This demonstrates an important misunderstanding of the meaning of the SD and how it should be used to interpret data correctly. The examiners were looking for answers that demonstrated an understanding that the difference between the means was small and that the standard deviations overlapped.

Question 3 (a)
Many candidates knew what an electrocardiogram was, but they found it hard to describe their answers with clarity. The examiners were looking for answers that explained it as a wave of electrical activity in the heart during the cardiac cycle.

Question 3 (b)
The use of a spirometer to measure ling volumes was described by many candidates but this was irrelevant to the question asked. Many also described how to set up a spirometer and this again was irrelevant. The answer required students to explain that counting the number of peaks per time period would allow the breathing rate to be calculated. The best answers expressed this idea in peaks per minute and also explained that repetition would be needed to obtain the mean.

Question 3 (c) (i)
There was a lack of precision in many candidates' responses. For example, stating that there is more carbon dioxide is insufficient as we need to know where, that is, in the alveoli and in the blood. In the body is insufficient. Knowledge about chemoreceptors, respiratory centre and the medulla was generally very good. Very few candidates received a mark about impulses to muscles as they did not say more impulses or that they travel along neurones, or that the muscles involved are the intercostals and diaphragm. Imprecise language costs marks, so examiners also did not credit the idea of sending "signals".

Question 3 (c) (ii)
Candidates found this question challenging. Many thought that an increase in breathing rate would allow more oxygen into the blood which would then reduce the concentration of carbon dioxide somehow or other. Those who appreciated that an increased breathing rate would help to remove carbon dioxide from the lungs, resulting in a concentration gradient between the blood and the alveoli that favoured carbon dioxide diffusion out of the blood

gained credit. The most common answers gained two marks by making reference to the fact that carbon dioxide would be exhaled and the air that is inhaled would contain less carbon dioxide further away from the volcano.

Question 4 (a) (i)
There were many good answers that demonstrated an understanding that the visual system of kittens is similar to that of humans or that there are ethical considerations with regard to the use of human babies to consider. there were weak answers that discussed irrelevant similarities, for example, the fact that kittens and humans are mammals.

Question 4 (a) (ii)
Most candidates appreciated that using kittens from one set of parents would help to reduce the influence of genetic variation in the investigation.

Question 4 (b) (i)
There were many excellent answers that made reference to the bleaching of rhodopsin into opsin and retinal. Credit was lost if the term visual pigment was used rather than naming the pigment as rhodopsin. The conversion of *cis*-retinal into *trans*-retinal was often seen and was credited.

Question 4 (b) (ii)
This question challenged students and there were many blank spaces or short answers that lacked detail. Many candidates did not appear to really understand what was required. A number just said the kitten would become blind. Some did not seem to appreciate that if the visual cortex was not stimulated during this period structures such as neurones and synapses on the right side would atrophy but the left eye would be unaffected. Many referred to a critical window for development but did not appear to understand the term. Simply saying the visual cortex does not develop because of lack of stimulation is not creditworthy. Many candidates lost marks because their answers lacked the use of precise terminology used in the correct sequence.

Question 4 (c)
The mark scheme had a generous list of acceptable responses and most candidates gained a mark.

Question 5 (a) (i)
The vast majority of candidates chose the correct answer of B for this multiple choice item.

Question 5 (a) (ii)
The examiners were harsh when marking this question. Candidates who described the change in the potential difference in a multitude of steps, leaving the examiner to interpret, lost credit. The examiners were looking for answers that stated that the change went from negative to positive and that the total change was 100mV.

Question 5 (a) (iii)
Students need to be aware that sodium channels is not the same as sodium ion channels and that the former is not creditworthy (an example of precision of terminology); permeability of the membrane to sodium ions

'changing' is not the same as 'increasing' and, again is not creditworthy. That said, there were many answers that showed excellent understanding of the events that take place when the membrane is depolarised. Very few candidates were awarded the final two marking points about more sodium channels opening and the potential difference becoming positive because of excess sodium ions.

Question 5 (b)
This question challenged students, though some appreciated that the absolute refractory period and the fact that sodium ion channels are closed are reasons why the second stimulus had no effect on the changes in the potential difference.

Question 6 (a)
This question discriminated those students who had a GCSE understanding ("chemicals that transfer impulses across a synapse") from those who had an A level understanding ("chemicals in vesicles that bind to the pre-synaptic membrane and are released into the synaptic cleft to diffuse across to the post- synaptic membrane where they bind to receptors and initiate an action potential"). Again, candidates are encouraged to use detail in their answers.

Question 6 (b)
This question was well-answered with most candidates understanding how SSRI's help to reduce depression. A few gave confused answers implying that SSRI's remove serotonin from synapses.

Question 6 (c) (i)
Most candidates appreciated that the mean degree of muscle contraction decreased during this study on habituation. For many this was the only mark achieved. Very few offered an acceptable explanation which is what the question asked. The biological reason for habituation was expected but few seemed aware that calcium ion channels become less responsive which results in less being taken up by the sensory neurone resulting in less neurotransmitter release and fewer impulses along the motor neurone. Candidates are encouraged to look at the mark allocation and plan their answers accordingly.

Question 6 (c) (ii)
Candidates found it hard to apply the principles they had learnt from core practicals to this novel situation. Blank spaces were common and many candidates merely offered one way in which the method could be extended. If candidates had related the experiment they were asked to plan to that described in (c)(i), they might have realised that they had to use different volumes of a sound and measure the contraction of the muscles at each volume. Many failed to do this. Some failed to mention muscle contraction at all. Most did suggest controlling a biotic factor, such as the age or gender of each group of volunteers, but few suggested using the same type of sound or controlling an abiotic factor. Stating a bland description of an abiotic factor that should be controlled such as "same environment" is not creditworthy.

Question 7 (a)
This was a high scoring question for many candidates. The question discriminated well between those who could write a logical account, full of relevant information and using technical terminology throughout from those who are less impressive. Some spent a great deal of time describing glycolysis or the functioning of the electron transfer chain which is time wasted. Students need reminding that questions with an asterisk are those that test QWC (quality of written communication) and if their answer is predominantly a labelled diagram they are at risk of losing credit.

Question 7 (b)
This question posed few problems and most scored highly. The most common error was to refer to the nucleus as having a membrane rather than being double membrane bound. Those students who drew a diagram were allowed to gain credit providing they labelled the parts correctly.

Question 7 (c)
Those students who answered this question using A level terminology tended to score highly. Those whose answers were at GCSE level did less well. The examiners were looking for responses that showed an understanding that mutations are random changes to the sequence of bases in a DNA molecule.

Question 7 (d)
The calculation was done successfully by most candidates. Those who put 18.1 as their answer could still gain one mark if they showed in their working that they had divided 723 913 by 40 000, or they had divided 1 by 40 000 and multiplied that answer by 723 913. Students need reminding that it is always sensible to show working as credit is available if their answer on the dotted line is wrong.

Question 7 (e)
This question posed problems for most candidates. Many failed to understand the information in the passage and simply repeated verbatim sentences from paragraph 22, or the stem of the question. The examiners were looking for responses that showed that as a result of more glucose being present in the pancreas cells more respiration would occur with the consequent production of more ATP, and that it is the higher levels of ATP that are detected.

Question 7 (f)
This question also challenged students. The passage describes ooplasmic transfer as injecting a "bit of good egg into a bad egg". Examiners rewarded candidates who appreciated that the control should involve the physical process of injection, and that the material injected should not contain any substance present in a "good egg".

Question 7 (g)
Many students wrote at length about how a mutation could lead to the making of a non-functional enzyme but only a few were able to relate this to oxidative phosphorylation being stopped and the fact that glycolysis needs to continue if ATP is to be made available. This would mean that

pyruvate would be converted to lactate which would then accumulate in the body.

Question 7 (h) (i)
This question tested understanding of why preimplantation genetic diagnosis is a useful procedure. Answers that could also be attributed to amniocentesis or chorionic villus sampling were not credited. So, for example, students who commented on the health of the fetus or to avoid abortion of a child did not gain credit. PIGD allows choices to be made before these developmental stages occur. The examiners were looking for answers that made reference to embryos and demonstrated that the technique enables parents to know the genetic status of their embryos, information that helps decide whether to continue with implantation or not.

Question 7 (h) (ii)
Many reasons were given which were deemed not to be ethical so they gained no credit. For example, comments about religious belief were not credited, nor were comments about the chance that the procedure might produce false results. Students are encouraged to read the stem of a question before attempting their answer. Examiners were more generous in this item about the stage of development being discussed by the students.

Question 7 (i)
This question challenged most students. Many opted for the northern climate variant on the basis that it produces more heat which would help enzymes to function, or would help to maintain body temperature. Some candidates did appreciate that the tropical variant is the correct answer to help boost athleticism because by producing less heat it will produce more ATP for muscle contraction. The term ATP was needed to gain credit in the answer. Students who used the term energy instead of ATP lost credit.

Question 7 (j)
This was a challenging question in terms of its demand and its position at the end of the paper. There were many blank spaces which could be because students ran out of time or they failed to understand the underlying principles needed to answer the question. The examiners rewarded those students who explained the effect that rapid mutation of mitochondrial DNA could have on the ability of the copepods to interbreed successfully.

Paper Summary

The paper gave candidates the opportunity to demonstrate their knowledge and understanding; their ability to apply this 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
- In calculation questions, show your working, to avoid losing all the marks for a simple mathematical error

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