General Certificate of Education (A-level)
January 2013

Biology

(Specification 2410)

Unit 2: The Variety of Living Organisms

Report on the Examination
General Comments

The paper produced a wide range of marks and proved to be accessible across the full ability range. It was also pleasing to see less evidence of students writing answers of an inappropriate length. Routinely extending answers to extra pages is unnecessary and can result in students falling short of time later in the unit test.

There were some truly outstanding responses at the top of the ability range. Many answers conveyed an excellent grasp of subject knowledge and the ability to apply this to unfamiliar contexts. However, at the other end of the scale, it was clear that some students were ill-prepared for this examination. They struggled with basic recall and found questions that required application of knowledge demanding, as seen in Questions 2(c), 4(b)(i), and 5(d). More specifically, there was evidence of misreading questions, using scientific terms in the wrong context and going no further than simply to repeat the information given in question stems. This was most notable in Questions 2(a)(ii), 4(a), 4(b)(i), 6(b), 6(c) and parts of 9. However, it was pleasing to see that topics such as DNA replication, the effect of mutation on enzyme function and horizontal gene transmission were very well understood across the full ability range. This said, it was disappointing to learn in Question 5 that some students appeared never to have used a potometer. Similarly, in Question 9(b), very few students were able to interpret standard deviations.

There were also some common misconceptions seen throughout the paper, which have been described in relation to the appropriate questions.

Question 1

Given that this question was targeted at grade E, it is surprising that all parts proved to be good discriminators.

(a) Nearly half of students gained full marks. Students who did not showed a vast range of incorrect answers.

(b) Most students correctly named the type of reaction as ‘hydrolysis’. The most common incorrect response was ‘condensation’.

(c) Just over 60% of students gained full marks. This was usually for relating the insolubility of starch to no osmotic effect, or the coiled shape of starch to being compact. However, some students were prevented from scoring full marks due to giving a definition of ‘compact’. The response ‘compact so can fit a lot into a small space’ was frequently seen.

(d) Nearly half of students scored full marks. A common error seen in weaker responses was to divide the actual length by the measured length. Similarly, the ability to convert between millimetres and micrometres proved to be a good discriminator.

Question 2

(a)(i) Most students were aware that an organ consists of more than one tissue. Students who failed to score, usually described a tissue rather than an organ.

(a)(ii) This proved to be a good discriminator. Just over half the students gained full marks for being aware that muscles contract, causing vasoconstriction of an arteriole. Weaker responses often used scientific terms in the wrong context. It was not uncommon in such responses to read that muscles ‘constrict’ or that arterioles ‘contract’, ‘stretch’ or ‘recoil’. Similarly, some students did not seem to remember
which way around these events occur in the context of reducing blood flow. Consequently, some students stated that muscles contract and relax, and arterioles constrict and dilate but did not make clear which of these reduced blood pressure.

(b)(i) Most students were aware that a thin wall provides a short diffusion pathway. Weaker responses often referred to a diffusion gradient being maintained or faster diffusion occurring.

(b)(ii) Most students correctly linked slow blood flow in capillaries to more time for exchange. Again, weaker responses usually referred to faster diffusion occurring.

(c) It was disappointing that just over 40% of students scored zero. Many were aware that the water potential in the capillary would increase. However, the ability to tell the rest of the story proved to be an excellent discriminator. Weaker responses usually lacked precision or were out of context. They often referred to the movement of tissue fluid, rather than water. Similarly, some students described the movement of water out of the capillary, rather than less water moving into the capillary. It was clear that some students had difficulty in applying their knowledge of tissue fluid to an unfamiliar context and simply wrote all they knew about how tissue fluid is formed and reabsorbed.

Question 3

(a) Nearly half of students scored full marks.

(b) This proved to be an excellent discriminator. Many students were aware that a higher separation temperature meant that more hydrogen bonds had formed. However, some weaker responses lacked precision, e.g. ‘stronger hydrogen bonds' and ‘more similar DNA’.

(c)(i) Nearly all students were aware of the drop in population associated with a genetic bottleneck. However, the ability to explain the effect of this in terms of reduced genetic variation proved to be a good discriminator.

(c)(ii) Just over half of students gained at least one mark. This was usually for mentioning inbreeding, or that there would be a higher probability of inheriting the allele. Very few students mentioned meiosis. The misconception that inbreeding causes mutations was also seen. The weakest responses usually referred to ‘low fertility being passed on’ and ‘inbreeding increasing genetic disease’.

Question 4

(a) Most students correctly defined ‘intraspecific variation’. Students who failed to score typically described interspecific variation or intraspecific competition.

(b)(i) It was disappointing that only one-third of students scored at least one mark. Students who failed to score nearly always simply repeated information given in the question stem. Responses such as ‘to see if schizophrenia is due to genes or the environment’ and ‘identical twins are genetically identical but non-identical twins are not genetically identical’ were widespread. Only the very best responses referred to each type of twin and explained their role in determining the relative effects of genes and the environment in the development of schizophrenia.

(b)(ii) 70% of students were aware that the data suggested genes play a greater role in schizophrenia than the environment. Students who failed to score nearly always
gave statements that were not comparative, e.g. ‘genes are involved’ and ‘genes and
the environment are involved’.

(c) Just over 60% of students gained full marks with answers such as age, sex or family
history of mental illness. Weaker responses such as ‘health’, ‘lifestyle’ and
‘environment’ were not credited.

Question 5

It appeared that some students had not used a potometer. The investigative and practical
skills section of the specification for this unit clearly states that students require specific
knowledge of the use of a potometer to measure the rate of water uptake. It also makes
clear that students can be tested on this in the examination.

(a) Many students were aware that opening the tap would return the air bubble to the
start. Students who appeared unfamiliar with a potometer usually made incorrect
guesses from the diagram, e.g. ‘add water to the reservoir’, ‘remove the plant’ or
‘remove the bung’.

(b) 60% of students gained at least one mark. Better responses usually went beyond
ensuring that the apparatus was airtight. The question asked for specific precautions
that should have been taken when setting up the potometer. Despite this, weaker
responses typically named factors that should be kept constant.

(c) Given that this question has been asked in a previous series, it is disappointing that
over 60% of students scored zero. Better responses showed appreciation that water
is used for support and photosynthesis and produced during respiration. However,
weaker responses seemed to focus on the word ‘transpiration’ in the question stem.
Consequently, references to the opening and closing of stomata, effects of
environmental factors and not all water being used in transpiration were widespread.
Similarly, some students thought that water is used in respiration, or produced during
photosynthesis.

(d) This proved to be an excellent discriminator. Just under half of students scored at
least two marks. This was usually for appreciating that removing more leaves meant
fewer stomata, less transpiration and less tension. Unfortunately, weaker responses
often did no more than describe the relationship between the number of leaves
removed and the rate of transpiration. As in Question 2(c), some students had
difficulty in applying their knowledge to an unfamiliar context. They wrote all they
knew about cohesion-tension, without linking this directly to the data in the table.

Question 6

(a) This proved to be an excellent discriminator. Nearly half of students scored full
marks. This was usually for stating that the cell wall does not form, leading to cell
lysis due to entry of water. It was usually only the best responses that referred to a
lower water potential in the bacterium. Weaker responses revealed a number of
misconceptions. These often referred to the cell wall being broken down or that
isoniazid caused the cell wall to become permeable to water.

(b) Half of students were aware that human cells may lack enzyme B, use different
substrates, or produce different fatty acids. Weaker responses usually fell into one of
two types. The first suggested the idea that isoniazid is an enzyme. This led to
widespread references to enzyme inhibition and active sites on a variety of
molecules. The second used the fact that human cells do not have cell walls. The
question asked why isoniazid does not affect the production of fatty acids in human cells. Hence, reference to cell walls was out of context and was not credited.

(c) Two-thirds of students scored full marks and all marking points were regularly seen. Weaker responses were marked by the use of scientific terms in the wrong context, e.g. ‘different amino acids produced’, ‘base sequence of the enzyme’, ‘amino acid base sequence’, ‘amino acids coding for’ and ‘different hydrogen bonds form between bases’.

(d) Two-thirds of students scored full marks and all marking points were regularly seen. Indeed, better responses often contained all four marking points. However, some students wasted time writing about vertical gene transmission and natural selection. Weaker responses sometimes disqualified the ‘gene for resistance’ mark by using scientific terms in the wrong context, e.g. ‘bacteria become immune to isoniazid’.

Question 7

(a)(i) 40% of students gave one ethical argument for maintaining biodiversity that was of A-level standard. This was the idea of preventing extinction or loss of habitats. References to animal rights, or ‘playing God’ were classed as neutral.

(a)(ii) Just under half of students gave one economic argument for maintaining biodiversity. The most common responses that gained credit referred to medicine, tourism or agriculture.

(b) This proved to be a good discriminator. Nearly two-thirds of students gained at least one mark usually for the answer ‘fewer habitats’. Very few students mentioned that a lower percentage of the original forest meant that fewer plant species would be present. The ability to express the idea of ‘fewer food sources’ discriminated well. This was often conveyed in weaker responses as ‘less food’, which was not credited.

(c) 85% of students scored at least one mark. This was usually for ‘number of each species’. It should be noted that the specification requires students to be able to calculate one specific index of diversity. The ‘number of species’ is not required to calculate this index of diversity. Consequently, this response was classed as neutral.

(d) 70% of students scored full marks. Students who did not typically referred to surface area only, a larger SA:VOL, a smaller VOL:SA, fat or feathers.

Question 8

(a) This proved to be an excellent discriminator. Just over 70% of students scored at least half marks. Many were aware of the breaking of hydrogen bonds, the role of DNA helicase and complementary base pairing. However, it was only better responses that referred to the attachment of free nucleotides (as opposed to free bases) and both strands acting as templates. DNA polymerase was frequently mentioned but its role was often confused in weaker responses. This enzyme joins nucleotides on the newly formed strand, it does not cause complementary base pairing. Some students negated the mark for semi-conservative replication through poor expression. The most common examples of this included ‘each new DNA molecule contains half of the original strand’ and ‘new strands contain half of the original strand’. Very few students wrote about hydrogen bonds reforming.

(b)(i) Two-thirds of students correctly gave the duration of metaphase as 18 minutes.
(b)(ii) 80% of students correctly calculated the duration of anaphase as 10 minutes.

(b)(iii) This proved to be a good discriminator. Most students gained one mark for extending the horizontal line to 18 minutes, or decreasing this line to 0 µm at 28 minutes. Weaker responses often showed the horizontal line increasing.

(c)(i) 70% of students correctly calculated the time the cells were in interphase as 19.7 hours. Very few students gained the principle mark for multiplying by 0.82.

(c)(ii) Just under half of students were aware that cells in interphase could be detected by a visible nucleus or the inability to see chromosomes. Weaker responses typically referred to the inability to see DNA or that the cells in interphase would contain twice the amount of chromosomes.

(c)(iii) This proved to be a good discriminator. Most students were aware that cancer cells divide more rapidly than healthy cells. However, it was only better responses that referred to data in the table and correctly linked this to tissue D. Some students wrongly thought that more cells in interphase meant more rapid cell division due to increased DNA replication.

Question 9

(a) 60% of students scored full marks and the first route on the mark scheme was the most popular. Students scoring one mark typically mentioned ‘random’. However, some responses conveyed a failure to read the question stem carefully enough. Consequently, they answered a different question from the one asked and produced answers such as ‘reduces bias’, ‘use a double blind trial’, ‘ensure there is the same number of patients in each group’ and ‘do not tell patients which treatment they are receiving’.

(b) It was disappointing that 60% of students were unfamiliar with the use of standard deviation and scored zero. Only a quarter of students stated that the bars did not overlap and related this to the difference in results between Group 1 and the other groups as being significant, or not due to chance. Weaker responses that did make reference to the standard deviation bars usually went no further than to state that the bar for Group 1 was larger than that of the other groups.

(c) Three-quarters of students were aware that there was no evidence of a placebo effect, or that this effect was slight. However, the ability to link this to data shown in the graph proved to be a good discriminator.

(d) Two-thirds of students gained one mark for the idea that anomalies could be identified. However, some thought that repeats prevented anomalies from occurring or being recorded. It was only the best responses that referred to allowing a more reliable mean to be calculated. Taking additional readings does not necessarily allow results to be closer to the true value. Hence, references to ‘a more accurate mean’ were not credited. Weaker responses often referred to ‘the results' being more reliable or more accurate, without further qualification.

(e)(i) Just over half of students gained this mark. Students who failed to score typically repeated information given in the question stem. The most typical response seen was ‘so that the normal treatment was the same for all patients’.

(e)(ii) Almost all students scored at least one mark. This was usually for appreciating that the normal treatment would not affect the results. Weaker responses usually relied
on vague, stock *How Science Works* phrases, e.g. ‘so a comparison can be made’, ‘it would give less reliable results’ and ‘to make it a fair test’. There was also evidence that a minority of students failed to read the question carefully enough. Their responses referred to albuterolas, the normal treatment or FEV as the experimental drug.

(f)(i) 80% of students scored at least one mark. This was usually for stating that improvement scores are subjective or qualitative. Only 10% of students went further and suggested that some patients might lie, exaggerate or want to please doctors. Again, weaker responses typically repeated information given in the question stem, e.g. ‘the improvement score is how much the patients felt their symptoms had improved so it less reliable’.

(f)(ii) Almost all students scored at least one mark. This was usually for the idea that patients knew they were not receiving any treatment. However, two-thirds of students were able to complete the story by linking this to patients being more likely to give lower improvement scores.

**Mark Ranges and Award of Grades**

Grade boundaries and cumulative percentage grades are available on the [Results statistics](#) page of the AQA Website.