A-LEVEL
BIOLOGY

7402/3 Paper 3
Report on the Examination

7402
Autumn 2021

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General Introduction to the Autumn Series

This has been another unusual exam series in many ways. Entry patterns have been very different from those normally seen in the summer, and students had a very different experience in preparation for these exams. It is, therefore, more difficult to make meaningful comparisons between the range of student responses seen in this series and those seen in a normal summer series. The smaller entry also means that there is less evidence available for examiners to comment on.

In this report, senior examiners will summarise the performance of students in this series in a way that is as helpful as possible to teachers preparing future cohorts while taking into account the unusual circumstances and limited evidence available.

Overview of Entry

The entry for this paper was 584; this is far lower than the normal summer entry which is normally between 30 000 and 40 000.

The general standard of responses seen was somewhat poorer than in a normal summer series. The paper produced a range of marks from 2 to 63 (out of 78), the highest mark being four marks lower than in Autumn 2020. Correct responses were seen in all parts of all questions.

The background of the entry will be students who were not able to obtain a teacher-assessed grade, or who disagreed with their teacher-assessed grade from the summer. The standard of work seen was generally lower than that seen normally, with a far greater proportion of questions not attempted than usual. The answers to essay questions (07.1 or 07.2), however, were very much in line with a normal summer entry in terms of the mean score, and discrimination index.

Comments on Individual Questions

Question 1

Question 1 contained three parts that tested maths skills, and these proved difficult for students. With 01.1, students struggled to determine a starting point for their calculation, with several students trying to solve the question as an algebra problem. Only 27.49% of students scored 2 marks, with over half scoring zero, but the question did discriminate well. Question 01.2 fared even worse, with only 11.51% of students getting the answer correct. There were many responses that were not even frequencies, and many tried to use the Hardy-Weinberg equation despite being told not to. Question 01.3, the multiple-choice item, proved easier, with 73.02% of students answering correctly. With 01.4, students struggled to know what data to use, with 64.09% scoring zero marks on what is a percentage change calculation. With 01.5, many students simply repeated the stem of the question, which rarely scores marks on an exam. Students seemingly only referred to the left-hand side of **Figure 1**, and so struggled to score full marks (only 10.48% did). Students also misinterpreted the information given, thinking that the mutation caused αMSH to leave the receptor.

Question 2

Both parts of this question discriminated well. Over half of students were able to score marks on 02.1, but only 1.89% were able to provide a full description and score full marks. For mark points 3 and 4, a lot of vague language was seen, such as '*new viruses are made using the cell's own machinery*'. For question 02.2, only 4.98% of students scored zero marks, with the spread of marks showing a normal distribution. There were several students who misinterpreted the question, thinking the stem was outlining a drug trial that scientists had performed, rather than an 'accidental' discovery. Many rote-learned responses not in context were seen, such as '*no control*', '*no stats tests*', '*small sample size*', and '*do not know long-term effects*'. There were also students who thought there were 'levels' of HIV infection.

Question 3

Question 03.1 showed a lack of understanding of terminology, with only 18.56% scoring 2 marks. Incorrect responses included 'tropism' and 'kinesis' for MP1, and for MP2 there were many vague answers of '*to survive*' and many students stating that the beetles moved away from the light, which is the opposite to what is shown in **Figure 2**. There were also multiple incidences of beetles needing to move towards the light for photosynthesis. With 03.2, the majority could score at least 1 mark, but only 4.47% scored 2 marks. The question asked why the conclusions might **not** be valid, but several students answered why they were valid. Once again, students gave rote-learned responses, including '*small sample size'* (despite the stem stating, '*They repeated the experiment with many beetles…*') and '*there may be other factors*'.

Question 4

Both questions 04.1 and 04.2 discriminated well. With 04.1, there was a fundamental lack of understanding of the relationship between *GPP* and *NPP*, and that it relates to plants, not animals. There was also a large number of responses stating that carbon dioxide is required for respiration. With 04.2, students seemed to want to make their incorrect knowledge of the nitrogen cycle fit the question, rather than use the correct part of their knowledge, for example, stating that saprobionts are anaerobic and that nitrates are denitrified into ammonia. That said, 25.26% of students were able to score both marks. With 04.3, students were asked to state the assumption that the students in the question had made, and many failed to do so, possibly as they did not know what an assumption is. There was also a lot of confusion as to what biomass actually is, with many stating that biomass is dry mass. Question 04.4 was a better answered maths question, with 35.05% scoring 2 marks, and most correctly obeying the command to give their answer to the nearest full day. Those who scored 1 mark mostly failed to calculate the starting length.

Question 5

This question discriminated well, particularly question 05.2 which had the second highest discrimination index after the essay. Question 05.1 tests AO1 knowledge, but only 14.43% scored both marks, mostly stating MP1 in full, but not giving MP2. The range of answers given for 05.2 was vast, with many responses not being proteins (starch, glycogen, omega-3, etc.) and for reduced immunity often stating cells, not proteins. With 05.3, only 5.50% of students failed to score a mark. There was a lack of understanding and use of the term significant, with several answers stating '*no stats test has been included'*, despite the stem stating, '*A statistical test confirmed that the difference between the results shown in **Figure 4** was significant*'.

Question 6

Questions 06.1 and 06.2 discriminated well; however, on both over 17% of students failed to even attempt the question. With 06.1, only 1.20% scored full marks, and there was confusion between a DNA probe and a marker gene, with several answers describing *in vivo* cloning, others describing a tracer experiment, and several incidences of microarrays being used, the latter not being on the specification. There were also many incidences of students changing the radioactively labelled DNA probe into a fluorescent probe. With 06.2, it seems that students failed to understand what the stem was outlining, and, as such, examiners found a lot of misinterpretation in responses, with students stating that the antisense mRNA binds to the *SUT1* gene or the antisense mRNA makes the wrong protein. There were also several incidences of a fundamental biology mistake by stating '*translation of the SUT1 gene is prevented*'. Only 2.05% scored full marks, and 56.87% scored zero marks. With 06.3, students failed to understand that, in biology, ratios are expressed as 'something to one'; as a result, only 7.04% answered the question correctly. Students displayed poor knowledge of photosynthesis in question 06.4, and many students failed to grasp that the question stated ^{14}C and not $^{14}CO_2$. Incorrect responses included '*CO_2 is still produced in photosynthesis*', *'$^{14}CO_2$ is still taken in*', *'CO_2 is used for growth*', *'plants need CO_2*' and *'some still remains*'. Over 10% failed to attempt question 06.5, and only 0.34% scored full marks. Students were able to access MP1, MP2 and MP6, but rarely did they link MP3 and MP4 to the development or growth of the roots. Those who did often referred to '*nutrients'* for MP4 rather than minerals.

Question 7

Judging by the responses seen on the rest of the paper, it seems that many students opted to spend a lot of their time writing the essay, and not on Section A. The essay discriminated well. The majority of students elected to answer 07.1 over 07.2, but the better-quality answers were seen with those who chose 07.2. The mean score was 13.16, which is broadly in line with other years, and shows that students are still failing to address the theme (i.e. 'the importance of') at all, or at the correct depth. Students are also failing to bring in material beyond the specification at the correct depth, or failing to write the rest of their essay at the correct depth which would allow them to access 24 and 25 marks, with only 0.52% of students accessing these marks.

With 07.1, there were a great many students who elected to write about enzymes; however, they rarely went beyond GCSE level depth, only discussing the 'lock and key' model, and not the 'induced-fit' model required by the specification. A large proportion of students thought that anything bonding together meant that the shapes were complementary, for example haemoglobin and oxygen. This is not the case, as oxygen shares a pair of electrons when it binds in a coordinate bond, and so not 'complementary shapes' in this case and an irrelevant topic. The essay title also states '*in organisms*', therefore *in vitro* cloning and the ELISA test would also be irrelevant topics. Good knowledge was shown about DNA replication, cell recognition and the immune system, respiration, nerve impulses, synaptic transmission and muscles. The control of blood glucose was well answered, but there was confusion and hybridisation of the terms glycogenesis, glycogenolysis and gluconeogenesis. Attempts at the theme, for example, didn't often stretch beyond '*without respiration we would die*', or '*if muscles couldn't contract, predators couldn't catch prey'*. Better responses brought the importance up to A-level depth, and considered either the importance of the shapes being complementary to organisms or the metabolic processes they were involved in, or the consequences of them not being complementary.

With 07.2, as aforementioned, the responses tended to be better, with good knowledge displayed about ATP, co-transport, haemoglobin, respiration (although some students did state that hydrogen ions are actively transported from the mitochondrial matrix to the intermembrane space, which is incorrect), receptors, nerve impulses, synaptic transmission, muscles, and the control of blood water potential. There were good attempts at the theme with this title, students stating why ions were important for the metabolic process, or the consequence of the metabolic process failing due to a lack of that ion.

Concluding Remarks

Overall, the demands of the paper are perhaps ever-so-slightly harder due to the nature of the material being tested in question 6 compared with last year's question 6. Students handled the question about HIV better than expected; this has typically been an issue in previous series. Overall, students seemed to find AO1 items harder and AO3 items easier this year. However, with such a small sample size, this might be specific to just this series. The level of scientific language, spelling, punctuation and grammar used was slightly better than in the previous series.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.