A-LEVEL
BIOLOGY

7402/3 Paper 3
Report on the Examination

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General Introduction to the November Series

This has been an 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 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 vastly reduced from a normal summer series, from around 33 000 to just under 1200.

The general standard of responses seen was somewhat poorer than during a normal summer series. The paper produced a range of marks from 1 to 67 (out of 78), the highest mark being a few marks lower than in summer 2019. Correct responses were seen in all parts of all questions.

Almost all the marks for factual recall with understanding (AO1) in this paper are in the essay. The remaining questions test AO2 and AO3 skills using contexts given in the questions. These mostly proved challenging for students. This was most evident in questions testing analysis of experimental data, where students tended to give rote-learned answers without considering the question. For example, many students stated 'no statistical tests performed' on question 05.3, which states in the stem of the question that two of the results had a significant effect, ie a statistical test had been performed.

The essay does require application of knowledge; about half of the 25 marks assess AO2. More successful essays demonstrated this, primarily in discussing the 'importance' at A-level standard. The vast majority of students' essays were confined to factual recall (AO1), which limited the mark they could be awarded to 15 (the modal score). There was also evidence of very low-scoring students attempting to include material beyond the specification, albeit poorly. To access the highest marks, the rest of the essay must also be in the Extended Abstract range.

Some students failed to obey commands in questions, such as 'Use **all** the information,' 'Do **not** include details of the cellular response in your answer,' and 'Use **Figure 4** to justify why professional athletes are **not** allowed to take GW1516.'

Comments on Individual Questions

Question 1

On 01.1, only 1.42% of students scored all three marks. The majority scored 0 or 1 mark. It appears that students did not understand the term 'limitation' and instead gave expected results or improvements to the investigation. Students also failed to give the second part of most responses,

for example just stating '10 minutes is too short'. Rote-learned responses were evident, such as 'no control' and 'don't know long-term effects.'

01.2 was better answered with roughly 20% scoring each of 1, 2 and 3 marks. The most common mistake was students stating that females with large brains would help males bright in colour by 'telling them' there are predators nearby.

01.3 discriminated well across the grade range. Oddly, most students missed out mark point 1, which is the main idea behind sympatric speciation (versus allopatric speciation). Many students gave 2 to 3 alternative versions of mark point 2 in their answer. The term 'genetic drift' appeared many times, with a clear lack of understanding of what it means. Many students also told the 'story' of how a species evolves over time, but not how it could evolve to become two separate species.

Question 2

02.1 was recall of a specification term and roughly 60% scored the mark. Mistakes included 'interspecies', or students thinking they had to name one thing livestock and ibex could compete for.

02.2 asked students to use **all** the information. Many failed to do this, instead giving generic ideas. There seemed to be a lack of understanding of the term habitat; students suggested that farmers could change the habitat of animals. There were also a lot of suggestions that farmers could alter the diet of animals. Responses also seemed to suggest that ibex are a type of livestock, despite the question stating they are a type of wild goat. Only 4% scored all three marks, and over 50% scored 0.

Question 3

Roughly 30% of students scored 2 marks on 03.1. It discriminated well. For mark point 1, there were generic responses stating 'the virus mutates', others simply stated how viruses are replicated and others misunderstood the question and explained how viruses evade a secondary immune response.

Only a quarter of students scored the mark on 03.2, with many not considering what the question had asked, ie techniques to analyse viral DNA. Instead they gave answers about analysing mRNA and proteins or immunological comparisons.

Although 03.3 is direct AO1 recall of knowledge from the specification, only 11% of students scored 2 marks. Mistakes included having antibody binding to DNA and RNA, and students stating that antigens could be identified, but then stating that this antigen would be used to make an antibody to use in a vaccine.

Aside from the essay, 03.4 was the question that discriminated best. Just over 37% scored all 3 marks, and it was generally well answered. Errors included not naming plasma cells and making B cells be macrophages. Despite being told not to include the cellular response in their answer, most students did.

Question 4

Nearly half of all students scored two marks on 04.1; errors included failing to add units, or not factoring in the maximum dose allowed.

Students were able to score mark point 1 relatively easily, with roughly 70% scoring at least 1 mark. Students did not consider the investigation for mark point 2, and gave generic responses such as 'give a placebo.'

Roughly 66% of students scored both marks on 04.3, and only 13% of attempted answers were wrong. Both 8513 and 8514 were acceptable answers here, as correct rounding would yield an answer of 8514; however, as 8514 patients was not reached by the calculation, an answer of 8513 is also acceptable in this case.

04.4 discriminated well and was well answered with roughly 44% scoring 3 marks. Where students made an error it was through trying to bring the kidney or the formation of tissue fluid into their answers.

Question 5

05.1 tested similar maths skills to 04.3 and nearly 72% of students scored both marks.

05.2 discriminated well, however only 14% scored 3 marks. There was confusion about what is the enzyme and what is the substrate. Students stated that EGCG binds to the promotor region instead of DNMT and also that ECGC and DNMT have similar shapes so bind to the same thing, despite being told that ECGC is a competitive inhibitor.

05.3 was fairly well answered, with only 11% failing to score a mark. There were many rote-learned responses in evidence, such as 'no statistical tests,' despite being told on **Figure 2** that two of the amounts of ECGC had a significant effect. Students also stated there was no control; there was. 'May be other factors', 'need to see long-term effects', 'small sample size' and 'correlation doesn't mean causation' were also often seen.

Question 6

06.1 discriminated well. Students did show understanding of this AO1 idea; nearly 58% scored at least 1 mark. Some students contradicted themselves by stating 'haemoglobin has a high affinity, so unloads oxygen easily.' For mark point 2, many students did not state that oxygen would be available for **aerobic** respiration; this is expected at A-level.

For what was a relatively simple maths question, only just over a quarter scored 2 marks on 06.2. The most common error was not reading from the axes correctly.

06.3 requires some logic to answer and, unfortunately, only 0.5% of students scored 2 marks, and only 7% scored 1 mark. Students did not understand the question, specifically what pCO_2 is, or what a physiological change is. Many students suggested what the long-term effects of exercise are. Conversely, the majority of students were able to score the mark on 06.4.

06.5 discriminated well, with roughly 82% of students scoring at least 1 mark. Students failed to use **Figure 4** as instructed, and gave responses in terms of taking GW1516 being 'not fair.' There was some confusion of the Krebs cycle and the Calvin cycle, and confusion between the functions

of slow and fast muscle fibres. Many students also seemed to think that when slow muscles fibres contract, they make ATP.

06.6 was badly answered, with under 3% of students scoring 2 marks. Commonly, students stated that red blood cells would take up too much space, leaving no room for glucose, or that red blood cells would use too much glucose and oxygen, leaving none for the heart. Whilst thrombus and embolus were accepted for mark point 2, and atheroma was rejected, it should be noted that these ideas are not on the specification, and do not need to be taught.

Only 5% scored two marks on 06.7 and very poor quality of language was evident. Again, rote-learned responses such as 'no statistical test' were seen. A lack of understanding of 47(±5)% was seen; students stated the standard deviations overlap. Students mostly discussed ideas around levels not being able to be controlled, and a surprising number suggested that EPO is addictive.

Question 7

The mean mark for the essay was lower than in 2019, being 12.9 compared with 13.6. The modal mark was 15. This shows that, once again, the vast majority of essays were solely based around factual recall, with little attempt to address the theme, ie 'the importance of', either at all, or at A-level depth. Roughly half of the essay marks are dedicated to this theme, and reward AO2. Therefore, comments such as 'without respiration or photosynthesis organisms would die', 'muscle contraction enables movement away from predators' or 'without DNA replication we could not grow or repair' do not qualify as addressing the theme at A-level depth.

The level of response mark scheme makes references to 'several topics' being covered in order to qualify for the top two levels. The 'commentary' on the scheme defines 'several' as at least four topic areas. It was pleasing to see that there were few essays in which students wrote at length about only one or two topic areas, which would have limited them to a maximum of 10 marks, although on 07.1 there were very lengthy discussions of digestion stretching to two to three pages. Students would be well advised to write about five (or even six) topic areas, as a form of insurance.

There were more essays than usual that failed to reach A-level depth, with attempts to cover many topics, but only at GCSE level or below. This was more the case with 07.2.

Attempts to include material beyond the specification were seemingly more common; however, only 0.42% of students included this material at the correct depth. Just knowing the name of an enzyme not named in the specification does not qualify as material beyond the specification. There needs to be a detailed paragraph. To achieve 24 or 25 marks, the contents of an essay must meet all the criteria for the 21 to 25 (extended abstract) level and contain material that is beyond the specification content and at (at least) A-level standard, ie not anecdotal.

The functions of enzymes and their importance in organisms was by far the more commonly chosen essay title.

The essay title states the function of enzymes and, to that end, prolonged discussion of enzyme structure was often seen, but was not relevant here. In terms of functions, most students failed to move beyond the 'lock and key' model of enzyme action.

The title also states the importance of enzymes **in** organisms, therefore the use of enzymes *in vitro* as part of recombinant DNA technology is not relevant.

As aforementioned, many students wrote everything they could about digestion, stretching to 2-3 pages. Whilst the detail seen often was of A-level standard, the importance of the enzymes of digestion was rarely stated.

Many students made errors with DNA replication, stating that hydrogen bonds are hydrolysed, and that DNA polymerase forms hydrogen bonds between bases.

Whilst the knowledge of photosynthesis and respiration seen was of A-level depth, it should be noted that coenzymes are not enzymes. Almost every student considered them to be, and whilst they were not penalised for this confusion as a significant error, unless they ended up at ATP synthase, the discussion of coenzymes would be irrelevant.

The causes and importance of variation and diversity in organisms was rarely answered and, when it was, responses rarely went beyond GCSE level. Little technical terminology was seen. This was very evident with discussions of meiosis and evolution. The latter also had either wrong or very outdated explanations of the evolution of certain named characteristics.

Mark Ranges and Award of Grades

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