AQA

AS LEVEL
BIOLOGY

7401/1
Report on the Examination

7401
June 2016

Version: 1.0

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General comments

The paper produced a range of marks from 0 to 66 and correct responses were seen in all parts of all questions. Examiners commented that many students appeared not to have prepared thoroughly for the examination. This was most evident in questions testing factual recall. Students also tended to score poorly in questions relating to new specification content and the new mathematical requirements. Performance on questions relating to practical skills was very varied but generally poorer than on similar questions in ISAs and EMPAs from the legacy specification.

Many examiners commented on the poor handwriting of large numbers of students. There were also many students who appeared to have used a colour of ink that produced very faint script on the online marking system. Examiners can only mark what they can read. If a student has handwriting that is perceived to be a bit difficult to read on paper, it will be harder to read in a scanned, online form.

There were a number of questions where many students failed to obey the command word, or to use information or data provided in questions, even when told to do so. It appeared that they frequently failed to read the stems of questions carefully enough, even when words were emboldened. A number of questions involved (simple) logical steps that could only follow from appreciation of the content of the stems of questions.

Question 1

The factual recall question, 1.1, proved far more challenging than intended. Only 5% of students obtained both marks and 54% failed to score. There was no particular pattern to the wrong answers.

Question 1.2 discriminated very well, with 15% obtaining three marks and 21% scoring zero. There were good, concise answers that scored three marks for including complementary base pairing and the role of DNA polymerase in joining nucleotides together to form the new DNA strand; often in two or three lines.

Many students failed to read the question carefully and did not answer the question as set. They wrote at length about DNA replication, starting with DNA helicase. These answers were awarded a maximum of two marks, because the question specifically asked how the complementary strand of HIV DNA is made. Many students appeared to believe that DNA actively pulls free nucleotides into place and makes them base pair; some even wrote about condensation reactions. There were students who confused transcription with replication and gave accounts of mRNA production.

Some students appeared to focus on ‘HIV’ and ‘replication’ and gave an extended account of how HIV infects cells, uses reverse transcriptase to make DNA, incorporates its DNA into host DNA, takes over the cell, is replicated by the host cell, infects new cells and leads to AIDS. They often went onto an additional page, or wrote their answer under 1.3 on the next page, in breach of instructions given on the front of the exam paper. Many of these students may have found themselves short of time for later questions.

In 1.3, it was pleasing to find that many students did obey the command word to ‘contrast’ and gave full statements about the differences between DNA and RNA. Many students knew enough about the structures of DNA and mRNA to give correct contrasting features and 47% obtained all three marks.

Question 2

About two thirds obtained the mark in 2.1 for a correct description of the difference between a triglyceride and a phospholipid. Those who failed to score either did not know about the structure of these molecules or just described the structure of a phospholipid (or triglyceride).

In 2.1, about 40% of students could fully describe how to test for a lipid and obtained both marks. A minority described tests for other biological molecules. Many made errors in their descriptions of the emulsion test or of a positive result. These errors included: adding water before ethanol, heating the mixture, the presence of a precipitate and failing to note that the colour of the emulsion would be white.

Most students scored the mark in 2.3. Those who didn't got saturated and unsaturated the wrong way round in terms of carbon-carbon double bonds.

In 2.4, 28% obtained both marks for stating that the fat substitute would not bind to the active site of lipase because it has a different shape to a triglyceride. A similar percentage obtained one mark. Those who failed to score often ignored the question's reference to lipase and wrote about bile salts, micelles and methods of absorption.

Question 3

The specification (section 3.1.6) requires students to know that ATP is resynthesised by a condensation reaction involving ADP and phosphate, catalysed by ATP synthase. The examiners did not require reference to 'a condensation reaction' but only 26% of students obtained both marks in 3.1. About 40% obtained one mark for reference to ADP and phosphate. Some failed to score that mark because they wrote about phosphorus. Many wasted time writing about hydrolysis of ATP but often went on to describe the reaction between ADP and phosphate.

The same section of the specification (3.1.6) requires students to know that the hydrolysis of ATP can be coupled to energy-requiring reactions, or the phoshorylation of other compounds (often making them more reactive). In 3.2, 35% of students obtained one mark for reference to ATP providing energy for a reaction (usually named). Only 3% did this and then made reference to phosphorylation to obtain the second mark.

In 3.3, about 40% obtained the mark by noting that the image was 3-D. Many simply wrote that the evidence was the black and white nature of the image.

About 56% of students obtained both marks for the calculation in 3.5. Some (about 30%) had the right idea in terms of what to divide by what but couldn't handle the units and obtained one mark.

Question 4

It was pleasing to see that 73% of students obtained all three marks in 7.1. It was also pleasing to see 80% correctly identify hydrogen bonds in 4.4.

In both 4.2 and 4.3, students usually appeared to ignore the diagram in **Figure 3** and the information given, despite being instructed to use both in their answers. Students were told that **Figure 3** shows how a plant cell produces its cell wall. In the stem of 4.2, they were told that one function of protein Y is to transport cellulose molecules across the bilayer. The figure shows substrate molecules approaching the end of the cellulose molecules. Only 12% of students put all this together and wrote that Y was an enzyme (one mark) that makes cellulose (one mark), or that

Y makes cellulose (one mark) from β glucose (one mark). Some identified Y as an enzyme for one mark but then had it breaking down cellulose into substrate. Most students (68%) wrote about Y transporting various ions or other substances not mentioned in the information or figure, or about membrane stability. In 4.3, many students did not seem to appreciate that evidence is something to be seen.

Question 5

It was pleasing to see that most students (86%) could name the products of the hydrolysis of sucrose in 5.1.

In 5.2, it was heartening to see how many students could correctly calculate the rates and express them in standard form. Graphing the data proved much more challenging. Only 6% of students obtained all three marks. About 2% did not attempt to draw a graph. About 29% failed to score after attempting the graph for reasons including: axes the wrong way round, non-linear scales and failure to identify the axes. About 27% obtained 1 mark for putting rate on the y axis and time on the x axis and using linear scales. About 37% obtained two marks for also correctly plotting correct numerical rates and joining the points (with a line of best fit or point-to-point). Only about 6% could correctly label the y axis, with rate as μg minute^{-1} times 10^{-3}. A very large number of students appeared to think that rate = minute^{-1} (or 'per minute). A rate is something per unit time, in this case μg. The rate is proportional to one over time.

In 5.3, students were asked what they could conclude about growth of plant cells from these data. They could answer using either the raw data in the table, or their graph. Many simply described the data and failed to score (38%). A similar number obtained one mark, either for noting that the rate of hydrolysis of sucrose increased as growth occurred, or that growth levelled off after 8/10 days. About 18% obtained two marks for mentioning both of these points. Only about 2% also linked hydrolysis of sucrose to growth in some way and obtained a third mark.

Question 6

In 6.1, 29% obtained both marks. The idea of induced fit was generally known but often poorly expressed. Some students wrote about the substrate having the same shape as the active site, rather than a complementary shape. A minority had the active site on the substrate.

The rate **at** 10 minutes in 6.2 was correctly calculated by 22% of students. These students drew a tangent to the curve at 10 minutes and used it to calculate rate. 19% of students obtained one mark after drawing an incorrect tangent, or making a mistake in their calculation from a correct tangent. The remainder simply divided the y axis number by the x axis number at 10 days and failed to score.

In 6.3, many students simply described the curve, rather than explaining. Some attempting an explanation incorrectly wrote about the enzyme being used up, or all its active sites being occupied. 13% obtained both marks for writing about a rapid rate at the start because there is lots of starch and the rate levelling off/falling to zero after 25/30 minutes as all the starch is used up. Some 43% obtained one mark for making one or other of these points.

Question 6.4 was based around skills that students were expected to have developed in required practical 3; that is to say the production and use of a calibration curve. The purpose of the required practicals is, generally, to allow students to practise and develop skills that can then be applied in many different settings. 21% of students obtained one mark, either for noting that the scientist would need solutions of maltose of known concentrations, or that a calibration curve would have concentration on the x axis and colorimeter reading on the y axis. About 12% obtained both of these marks. Only 5% then went on to (briefly) describe how the calibration curve would be used to determine the concentrations in the experiment.

Question 7

7.1 was a very good discriminator. 19% obtained all four marks, 14% failed to score and equal percentages obtained one, two or three marks. Many students had the idea that a vaccine contains antigen and knowledge of antigen-presenting cells was common. There were also many correct statements about plasma/B cells releasing antibodies. Fewer students had the idea of a B cell dividing to form plasma cells. Not many students were able to express clearly the idea of a specific helper T cell or B cell detecting, or responding to, a specific antigen. Quite a few students got confused between the roles of T cells and B cells. Some students wrote at length about memory cells and secondary responses, neither of which was required to answer the question. As in some other questions, this inclusion of irrelevant material often generated additional pages and wasted time that could have been spent on other questions.

Most students obtained one mark in 7.2 for suggesting greater antibody production with two vaccinations. Almost none went on to make any other suggestion.

In the mathematical requirements section of the specification (pages 62-66), selection and use of a statistical test is not emboldened and so is required content for both AS level and full A-level. This is different from the legacy specification and answers to 7.3 indicated that most students had not learnt this. Only 6% of students could name the t-test and give the reason as testing the difference between means. Further guidance about teaching statistics is provided in the support materials on the AQA website.

Rather like 3.2 (two uses of ATP), the examiners were expecting statements from the specification in answers to 7.4. In 'Investigating diversity' (section 3.4.7), genetic diversity is compared (amongst other ways) by looking at base sequences of DNA and base sequences of mRNA. Very few students (3%) came up with both of these but some (27%) managed to express one of them.

Question 8

Most students managed to score marks on 8.2. Most (about 45%) noted that the chromatids would not separate and obtained one mark. Many (39%) went on to deduce that this would mean all of the chromatids/chromosomes would go to one pole of the dividing cell and obtained both marks. Some students got confused between sister chromatids and homologous chromosomes.

8.3 was about the same context as 8.2, where the kinesin inhibitor was linked to prevention of successful mitosis. It was hoped that students would appreciate that slowing or stopping mitosis would be a good thing when treating cancer (section 3.2.2). Most students made no reference to slowing or stopping mitosis when considering the results in 8.3. As a result, few went on to discuss the prevention of spread of cancer with KI at 100 nmol dm^{-3}. Some even suggested that a low KI dose would be better because it would allow more cell division. Many students *described* the results at length. Students can usually be relied upon to comment on the method used in an experiment, but here almost none of them noted that the doses of the drug were being tested on cells grown in culture, not on people.

8.4 tested a basic experimental skill. Broadly, 41% could describe how to make the required volume of the required solution and 49% could not. A minority had the correct proportions of solutions but the wrong volumes.

Question 9

The questions here related to the passage and students who used information and ideas from the passage tended to do well. Many students appeared to attempt the questions without considering the contents of the passage. Students should be aware that great care is taken to reduce the length of the passage as far as possible, retaining only content that is useful and necessary.

In 9.1, the passage stated that amyloid-precursor protein is large, has a complex shape and is the substrate of two *different* enzymes. About 14% of students correctly suggested that each enzyme would have an active site that binds (specifically) to a different site on the amyloid-precursor protein. (This would be rather similar to endo and exopeptidases acting on a protein – see specification section 3.3.3.) Many students wrote about induced fit allowing an enzyme to adapt its active site to fit a/any substrate, so both enzymes would bind to the same place on the substrate. Others had active sites on the substrate that could adapt to the enzymes.

Question 9.2 produced more discrimination than expected. About 27% obtained both marks, for noting that a peptide bond is broken and water is used in the process. About 43% obtained one mark for one or other of these points, usually the use of water. The others either didn't know, or suggested water was given off in the reaction.

In 9.3, few students could string together all three points on the mark scheme. Many appeared to be unable to use information from the passage to come up with any sensible suggestion of how the mutations could lead to Alzheimer's disease, such as a faster/greater production of plaque.

In 9.4, about 46% obtained one mark for describing what a competitive inhibitor is and how it acts by binding to the enzyme's active site. About 30% were then able to go on and apply this knowledge to the context in the passage and suggest that the inhibitor would reduce or stop β-amyloid or plaque formation. Some students attempted to hedge their bets by saying that the inhibitor changes the enzyme's active site but not saying how. This approach was not given credit. Some students thought that active sites are on substrates and failed to obtain the first mark point. Students who could not remember what competitive inhibition of an enzyme entails were unable to access 9.4. 23% of students failed to score on 9.4.

9.5 could only be answered using information from the passage. About 20% of students obtained this mark by noting that the brain normally has the enzymes, and produces the proteins, mentioned in the passage and they must, therefore, have some necessary function (that the drugs blocked).

Mark Ranges and Award of Grades

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