GCSE

BIOLOGY

8461/1H

Report on the Examination

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General

Many students rose to the challenge of the increased demand and wider specification. However, it was evident that a significant number of students would have been better served by taking the Foundation tier paper, which gives access to grade 5.

There was little evidence of students being short of time to complete the longer paper, with detailed answers being given through to the final question part by the vast majority of students.

The quality of writing was generally sufficient for examiners to determine what they intended, although the quality of the English used was occasionally difficult to understand. Students should be reminded of the need to read through their answers carefully, if they have time at the end of the examination, to ensure they have written what they intended. Examiners can only mark what is written and cannot second-guess what a student might have meant to write.

Apart from where students decide that their first answer is incorrect and cross it out, there should be no need for students to use additional pages, as the space provided is considered to be more than adequate. However many students did continue answers on additional sheets, sometimes by only a couple of words. Examiners are able to see the whole script, so if answers continue below the lines provided, these will still be marked. However what may not be seen are answers that continue outside the printed box on the paper and students should be reminded not to write in this space.

Levels of demand

Questions are set at three levels of demand for this paper:

- **Standard demand** questions are designed to broadly target grades 4–5.
- **Standard / high demand** questions are designed to broadly target grades 6–7.
- **High demand** questions are designed to broadly target grades 8–9.

A student's final grade, however, is based on their attainment across the qualification as a whole, not just on questions that may have been targeted at the level at which they are working.

Question 1 (standard demand)

01.1 A correct answer had to refer to toxins or poisons, which are the cause of symptoms of a *Salmonella* infection. Though it was not required, if a source was given for the toxins or poisons, it had to be correct. Thus, an answer which referred to 'toxins from the virus' was not awarded the mark.

Other students who did not achieve this mark often referred vaguely to *Salmonella* interacting with the stomach or intestine.

01.2 The most common response from students which received no credit was simply 'washing hands'. A little more than this was required for a mark to be awarded ie **when** hands should be washed to help prevent the spread of the bacteria to other people eg after using the toilet.

Another common misconception was that the *Salmonella* bacteria are spread by droplet infection and hence an answer suggesting covering your nose or mouth when coughing and sneezing was not creditworthy.

Many students achieved credit for the suggestion of isolation as a method of preventing the spread of the pathogen between people. Many of these students suggested how this isolation could be achieved eg keeping away from other people.

01.3 The correct answer, 'antibiotics' was very well known with 94% of students achieving this mark.

01.4 The first mark required the idea that the immune system is not functioning correctly in a person with AIDS. This could be expressed in a variety of ways, such as the immune system being weakened.

The second mark was awarded for a reason the person with AIDS does not recover as quickly which could, for example, be achieved by explaining that white blood cells can't kill the bacteria.

More students gained the first marking point than the second one eg they knew that AIDS weakens the immune system but then did not go on to explain fully why this meant recovery from the *Salmonella* infection would take longer. A common misconception was the idea that the immune system would be too busy with AIDS, so unable to deal with the *Salmonella* infection.

01.5 The question required students to suggest what the farmer could do to prevent the spread of the transmission of *Salmonella* bacteria from chickens to humans. It was not what a person could do to avoid contracting the bacteria.

Despite vaccination already having been described in the question stem as one method, many students gave this as their response. This highlights the importance to students of reading every question stem very carefully.

Answers that simply referred to 'chickens' being (for example) isolated were not given credit, as it was not clear if students were referring to the infected chickens or to the healthy ones. Suggestions of improved hygiene or disinfecting were ignored. 46% of students correctly suggested killing or isolating the infected chickens.

01.6 Students needed to study the figure carefully and give a full answer if they were to achieve this mark. It was insufficient for them to refer loosely to liquid B 'killing more bacteria', or simply to the numbers of bacteria present after use of the liquids, as there are situations where this is not true. Further qualification was necessary, with a reference to both surfaces.

01.7 Many students made good and correct use of the term 'zone of inhibition'. This question was answered well with 57% of students correctly quoting either 'radius' or 'diameter'.

A number of students misinterpreted the question and gave answers explaining how to calculate the area rather than what measurement had to be made. Some students gave the formula πr^2 and did not explain that r was the radius of the area with no bacteria growing.

01.8 Many students did not show an understanding of the term 'repeatable' as stated in the AQA science subject vocabulary. They answered by suggesting that another scientist should carry out the investigation or that different bacteria or a different temperature should be used.

Some students just said 'repeat' or 'repeat and compare', neither of which were sufficient as the question also needed a reference to the idea of seeing **if** the results were similar.

01.9 Most students who achieved this mark did so by referring to possible toxicity of the cleaning liquid. Answers such as 'checking if it is harmful' were insufficient.

Students who had followed the theme of the question through also often referred to the effect on other types of microorganism. Students who did not achieve the mark often gave the factor that had already been investigated, the extent to which the liquid kills the (Salmonella) bacteria or referred to 'cost', despite having been told that the liquids cost the same per dm^3.

Question 2 (standard demand)

02.1 By far the most common correct responses referred to either respiration or protein synthesis. Metabolic reactions in plants were rarely given. Students who did not gain this mark often referred to digestion in the alimentary canal, which is extra-cellular, or gave a description of metabolic rate.

02.2 Almost all students managed to identify at least one correct conclusion, from those given in the question, with 85% of students identifying both correct conclusions.

02.3 62% of students achieved all three marks here, often rounding to three significant figures directly from their calculator displays. Incorrect rounding at some point in the calculation occasionally lost a mark. In addition, not recognising that the first 0 after the decimal point counted as a significant figure (giving an answer of 32.08), also cost some students a mark.

02.4 27% of students did not achieve marks because they either didn't describe changes in the heart rates in response to exercise or didn't compare the two people, both of which the question demands. Of these, some students simply compared resting heart rates, or overall heart rates with no reference to the impact the exercise had on the heart rate.

The most common answer given by students satisfied the first marking point. The second marking point was rarely awarded as students did not make the comparison between the two people. They were often able to correctly say that the heart rate for person R levelled off, but did not go on to compare this to the continued increase for person S.

If students calculated the overall increase the figures given were usually correct. A few students calculated the percentage increase, also usually correctly.

A few students attempted to explain the differences in terms of fitness, rather than simply describe the differences.

02.5 Completion of the graph was generally well done with 69% of students achieving all four marks. Where marks were lost it was often due to incomplete labelling of the *x*-axis, such as omission of part, or all, of the label, or giving the unit as 'm', rather than an appropriate unit.

Incorrect plotting was rare; although some appeared to have plotted the values at 3 and 4 minutes on 118 and 128 this was accepted as in tolerance.

A significant minority of students did not draw a graph at all and simply added a scale and label, achieving only one mark.

02.6 This calculation was worked out either by subtracting the two heart rates and dividing by 12 or by sequential deductions of 12 from the higher heart rate.

A substantial number of students arrived at the correct answer by one of these methods, but the most common mistake was to arrive at 4 or 5 minutes (rather than 4.5) by the deductions method and not factor in the correct subtraction of half a minute's heart rate decrease. Some students rounded up to 5 minutes having reached the correct answer initially despite not being told to give the answer as a whole number.

Some students divided 132 by 12 without accounting for the fact that the heart rate only had to fall to 78, not to 0.

02.7 It is important that students understand the need for investigation designs to provide **valid** outcomes. In this case, the use of only one or two individuals of each type will not do this and those students who went down this route could not reach level 3. Furthermore, repetition with the same individuals is not equivalent to having large numbers of participants.

There were many good answers with students identifying several control variables, other than those involved directly with the exercise. Most students recognised the need to measure heart rate before and after exercise (and often all the way through as well) but then did not make it clear how they would use that data to calculate the increase in the heart rate. Many simply suggested calculating a mean without specifying what they would be taking a mean of.

Some suggested plotting the data on a graph and comparing the gradient from a smoker with a non-smoker which is a valid way of comparing an increase without subtracting starting rate from end rate.

Question 3 (standard & standard / high demand)

03.1 72% of students achieved at least one of these marks and many gained both, commonly giving two out of carbon dioxide, water and glucose. However, many students did not distinguish between substances, as required by the question, and various blood cell types were given, which were not acceptable.

03.2 There were two common omissions in answers. Firstly, many students omitted any reference to haemoglobin. Secondly many students did not link the increased oxygen supply to muscle cells, which would be needed by the athlete; and instead just indicated increased oxygen in the body, generally.

A significant minority of students referred to energy being made, created or produced, which will always disqualify otherwise correct answers.

03.3 The most common error was to identify the pulmonary vein, rather than the pulmonary artery as carrying deoxygenated blood. Most students achieved at least one mark by identifying vena cava.

03.4 The correct answer 'B' was most commonly given, but the other two alternatives were occasionally seen.

03.5 This question asked for a comparison between an artery and a vein. Many students wrote about arteries and veins but did not make clear comparisons between them. Most marks were awarded for the alternate answer describing the walls of arteries as being thick(er) and the thin(ner) walls of veins. Very few students referred to the relative thicknesses of the elastic or muscle layers of the vessels.

Students who did not achieve marks often correctly stated that veins contain valves but made no further comparative statement about the lack of them in arteries. The difference in the size of the respective lumens was expressed in numerous ways; however thick or thin were terms not accepted as they don't describe the relative size of the lumens themselves.

This question would lend itself to a tabulated response thus ensuring a comparison for all answers was given but very few students took this route. Some students lost marks by referring to the cell walls of blood vessels which is clearly incorrect.

03.6 Most students added an X to the figure, but relatively few students (34%) achieved the mark. It appeared that despite efforts to clearly indicate where questions are being asked or instructions given, some students only respond when there are lines to write answers on.

03.7 There were many references to indeterminate cardiovascular diseases, with relatively few students (34%) knowing what a pacemaker is used to treat.

Question 4 (standard, standard / high & high demand)

04.1 Some students stated 'no, because they all increased'. This indicates that they only paid cursory attention to the numbers on the table and did not scrutinise them in sufficient detail.

Those who recognised that the result was anomalous did not go far enough in describing their reason, recognising that it was lower than the other values, rather than being much lower. A few students quoted values derived from the table but omitted the unit.

04.2 54% of students achieved both marks here. However common errors included using 75.7 as the denominator and incorrectly rounding their final answers. Whilst a specific number of significant figures were not required, when students round their values, they're expected to do so correctly.

04.3 The great majority of students recognised that this question involved osmosis and that water was passing into the egg. Students' description of the difference in concentration often had responses that referred to both solute concentration and water concentration, although most students realised that the (solute) concentration was greater inside the eggs than outside.

Answers that referred only to amount of water in the beaker / egg did not gain credit. A number of students omitted reference to the nature of the membrane and so failed to gain this final mark.

04.4 Many students found this question very demanding with 6% achieving at least one mark. Those who appeared to understand the basic ideas required still did not achieve marks as the question asked for details of the modifications required. Thus simply putting eggs into different concentrations of solution was insufficient; as was looking for an egg which gave no change in mass.

Due to the positive and negative changes, determining where any line crossed the *x*-axis was also insufficient as the axis could be drawn at different points on a graph, instead, students needed to refer to the zero-percentage change in mass.

04.5 This question was generally well answered with 40% achieving full marks. The majority of students recognised that the calcium ion concentration was higher in the cytoplasm and thus deduced that active transport was involved, requiring energy.

Once more, students who referred to energy being made, created or produced could not gain credit for the final marking point.

Question 5 (standard, standard / high & high demand)

05.1 Many students recognised the relevance of the phloem, although some of these simply stated that the phloem carries sugars, without linking this to feeding by the aphid.

Some students continued the theme from the previous question and linked 'high concentration' in the question to diffusion, osmosis or active transport.

05.2 Although many students showed some understanding of the reason for stunted growth, most did not go on to achieve three or four marks.

The lack of magnesium was often linked to chlorophyll deficiency, causing yellow leaves, although chloroplasts were sometimes confused with chlorophyll. The fact that reduced chlorophyll would lead to a reduction in light absorption was frequently omitted as students moved directly to a reduction in photosynthesis and in turn, reduced glucose production.

However a lack of glucose was only rarely linked to a shortage of protein or cellulose, but more commonly to a lack of energy which was insufficient. Many students were able to describe much of the process that happens when magnesium is not deficient but did not answer the question by stating that none of this would happen in the case of magnesium deficiency.

05.3 This was a new area of the specification and although many students knew that something had to be injected, most were confused either as to the organism receiving the injection or to the contents of the syringe.

At the next step the need for lymphocytes, cancer cells and the production of a hybridoma was not understood by many. Although many knew the term 'hybridoma' most answers described the wrong components. Specificity was only mentioned on very rare occasions, as was the need for the scientists to clone the hybridoma. Many students did know some details, but clarity of detail and explanation was frequently lacking.

Question 6 (standard, standard / high & high demand)

Following updated research information and communications with parents of children with cystic fibrosis, we have decided to withdraw the question on this topic from this paper.

It has been decided not to provide a replacement question as it would not be possible to determine accurately how a replacement question would have performed if it had been part of the original paper taken in 2018.

The following statistics may help you to make effective use of the remainder of the paper:

Mean mark (maximum mark)	
06.1	0.47 (1)
06.2	0.65 (1)
06.3	2.27 (6)
06.4	1.27 (2)
06.5	0.69 (1)
06.6	1.33 (2)
06.7	0.56 (4)
06.8	0.42 (1)
Question 6	7.66 (18)

Question 7 (standard / high & high demand)

07.1 The most common reason why students who took the right route but did not achieve full marks for this question was incorrect rounding part way through the calculation, eg, a value of 266.6 being used rather than 266.7. It was common for students to write down a long string of decimal places in their calculations.

07.2 Generally this question was well answered with 48% achieving three or more marks. Most students made good attempts to gain full marks and often wrote at length. The test for protein was well known by the majority of students. However, the need to describe both the starch test and the test for glucose was not recognised by a significant number of students, who often gave only the former.

In the starch test, students needed to refer to iodine solution, rather than just iodine. When describing the test for sugars, the need for heat was often omitted, with some students only referring to a water bath, rather than a hot water bath. Some students confused the colour changes for positive results.

07.3 Those students who started their answer with the idea that the lipase was breaking down fat into fatty acids (and glycerol) often went on to achieve full marks. However, many students attempted to describe their answers in terms of the neutralising effect of bile and thus resulted in no marks.

07.4 Many students gave the correct reason, referring to the subjective nature of the values. However, a significant number suggested that the measurement of time might be inaccurate due to a human error or a stop clock that was not accurate.

07.5 There were a number of students who confused the answers with that for question **07.3**. It was not uncommon for students to suggest that bile is an enzyme or described their answers in terms of the pH of bile or its effects on pH of the mixture.

Those students who recognised that the difference was due to emulsification of the fat in milk often went on to describe the consequence on surface area. However, the final mark was often poorly explained or lacked detail, with students often suggesting that the bile, rather than the lipase, broke down the fat more quickly.

Use of statistics

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account on how students have performed for each question.

Mark Ranges and Award of Grades

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