



GCSE

BIOLOGY

8461/1H Paper 1 Higher tier
Report on the Examination

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General comments:

There were six questions on this paper, two of which were common with the GCSE Biology Paper 1 Foundation tier.

While the standard of performance in practical-based questions showed an improvement on previous years – in line with post pandemic expectations - it was sadly noticeable when a student had not been given the opportunity to carry out required practical activities to a good standard. Students were noticeably less able to access questions that assessed essential methods or skills students are expected to understand.

Some poor handwriting and faint ink made reading some students' responses problematic. Students are reminded that use of black ink is a requirement and are advised to ensure their pens deliver a dark black or their work may simply be indecipherable.

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 Whilst a large majority of students knew that a tissue consists of 'a group of cells', often adding 'working together'; these were insufficient to gain the mark. In order to be credited, students also needed to qualify this answer in terms of structure or appearance (ie 'being similar') or their functions being similar, and around 67% of students successfully gained the mark. As the question was asked in general terms, answers which gave the roles of specific tissues were not credited.

01.2 67% of students knew the name of this tissue. Common answers that failed to gain the mark included other cells or tissues that might be found in roots, such as 'root hairs' and 'xylem'.

01.3 63% of students were able to name 'willow' as the plant from which aspirin originates. Many students qualified their answers with specific parts of the willow, such as 'bark' or 'leaves' or just added 'tree' These details were ignored as being beyond expected knowledge. Incorrect answers included 'foxgloves' and 'fungus' as students mixed up the original sources of traditional drugs. Those who appeared not to have revised this area of the specification could only come up with improbable guesses such as 'the aspirin tree'.

01.4 Just over half of students gave correct responses in this question, with the most common correct responses referring to not causing damage or harm to the plant, or the idea that berries are easier to access. A number of students suggested that the berries would be 'easier to extract', which fell between the ideas of the berries being easier to access and the chemical being easier to extract; this idea was considered to be just sufficient to gain the mark. Suggestions that berries would 'grow back' after picking were insufficient as this would also be true of leaves and to some extent, of roots.

- 01.5** The most problematic part of this calculation was the conversion of grams to milligrams. Many students made no attempt at the conversion, stopping at '1.44', gaining 2 marks or alternatively '0.72' or '2.4', either of which gained just the first mark. Students who attempted a conversion, using factors such as 100, 10 or even 0.001, were able to gain the fourth mark, provided their answers matched this conversion factor. Unlike for more complicated calculations, most students laid out their calculations in a way that made interpretation fairly straightforward. Only a small minority of students appeared to have no idea of how to go about the calculation.
- 01.6** Many students were able to quote from their revision, that a 'lack of magnesium' would cause chlorosis. Whether this was expressed as a small deficiency or the plant getting no magnesium was not critical in gaining the mark. Other students were likely to offer ideas such as a 'lack of chlorophyll' or a 'lack of sunlight'. Only 17% of students failed to give a correct response with some suggesting that chlorosis might have been 'caught' or passed on' from other plants, without reference to a pathogen or infection.
- 01.7** Students were generally well-versed in the need for drug tests or trials, and 82% of students gained full marks. The most common error was to offer both the idea of checking toxicity and checking for side effects, as these amount to the same thing so could only be credited once. For many students the technical term 'efficacy' was well used, although some offered the idea of 'checking for efficiency', for which a mark was not awarded.
- 01.8** Although there may be many possible subordinate reasons for the writing of a biased report, all of these come down to one party or another being affected financially. Thus, only this idea was credited and the various reasons for this, such as 'disagreeing with the ethics' of the company were ignored.
- 01.9** A pleasing 90% of students correctly identified the need to have the claims peer reviewed.

Question 2 (Standard demand)

- 02.1** Around 78% of students could identify part A as the part that received oxygenated blood from the lungs.
- 02.2** Over 75% of students could identify part C as the part that pumps deoxygenated blood to the lungs.
- 02.3** Just over 63% of students could identify the right atrium as the part where the pacemaker was found.
- 02.4** This question was generally answered well with all of the marking points seen, including the fall-back mark. Almost 75% of student gained 2 marks, with a further 17% gaining 1 mark. Comparative terms were used by a large number of students but there were also many who simply described both vessels and achieved the marks that way. A lot of students gained two marks in one sentence by talking about the thicker muscle and elastic layers in the artery and then went on to give a third creditworthy response. The comparison of the lumen size was seen slightly more often than mention of valves, and most students used the correct term. If the student tried, instead, to describe the lumen they were often less successful. The most commonly seen uncreditworthy responses referred to cell walls, made general reference to the size of the vessels or, occasionally, mis-identified the two vessels completely.

- 02.5** Over 97% of students were able to successfully describe the trend, with many students doing so by using the whole of the headings from the table columns in their answers. Some used the terms correlation and proportional but there were as many incorrect uses of these terms as correct ones. Some students negated a correct description of the trend with an incorrect term. The most commonly seen uncreditworthy responses were references to a negative trend without further clarification or numbers quoted from the table with no trend referred to.
- 02.6** The graph appeared to be tackled better this year than it often has been in the past, may be because the y-axis scale was a simple one to determine and the points lead to a fairly easy curve to draw.
The axis mark was frequently awarded with only a few students squashing it into less than half of the grid available or using strange intervals.
The points were generally well plotted with the most frequent error being the failure to spot that they were not evenly spread along the x-axis and therefore plotting them in the wrong places.
There were fewer straight and point-to-point lines seen this year than there often have been, but there were still a significant number. However, some of the curves drawn missed the points by more than half a small square so were not acceptable.
The most commonly seen errors were points plotted with a large spot or a tiny mark rather than a cross, both of which made it very difficult to judge the accuracy of the plot, or thick, smudged or feathery lines, which again were too inaccurate to be awarded the mark.
- 02.7** Almost 90% of students were able to read accurately from their graph even if their line had not been creditworthy. Many drew construction lines but some of these were in the wrong place, reading from 25 or 30 on the x-axis. A few read from 35 on the y-axis.
- 02.8** This levelled response question required students to explain the effect of a partly blocked coronary artery on the human body. Answers across the whole mark range were seen for this question with less than 3% gaining no marks at all. Level 2 answers were seen in 45% of student responses with quite a variety in the quality of answers gaining 4 marks. The lack of understanding about the position and function of the coronary arteries prevented a large number of students accessing level 3. There were many suggestions that these arteries took the blood to the lungs or around the rest of the body, and reference to blood going through, rather than to the heart.
Many students correctly referenced reduced aerobic respiration, or increased anaerobic, with the consequent reduction in energy release, although there were the usual references to energy being produced, this was not penalised in this question. The most frequently seen part of the indicative content was reference to 'reduced blood flow around the body'. Better responses referenced the production of lactic acid and linked it to muscle fatigue. Some referred only to 'fatigue' so this was accepted as meaning general body tiredness. There were a lot of vague references to heart attacks and strokes, and these were only considered to be creditworthy at level 1 but elevated several answers from 1 mark to 2 within level 1. The most commonly seen uncreditworthy sections of an answer concerned references to blood clotting or immunity and the blockage causing back flow of blood. A minority of students referred only to what normally happens rather than what is happening in this scenario and there were a few lengthy responses that mentioned little that was creditworthy apart from a heart attack.

02.9 76% of students achieved 2 marks on this question, with the most common route to doing so via reference to stents. Most students could name them (and describe how they are fitted) although some did have to rely on describing them. Statins were also often seen although the second mark of that pair was a bit more elusive with lots of students suggesting they broke down the deposits that were already there. There were a few correct references to HDL and LDL cholesterol.

Reference to bypass surgery was occasionally seen although often not well enough described to attain 2 marks. An attempt at an explanation of a transplant was seen occasionally but there were no references to artificial hearts. The most common errors seen referred to surgery to physically open the vessel to remove the blockage.

Question 3 (Standard, standard/high and high demand)

03.1 A little over half of students correctly stated how *Salmonella* bacteria cause the symptoms of vomiting and diarrhoea. While the word ‘toxin’ was commonly used, many students failed to gain credit as they didn’t refer to toxins being released or produced which was essential for the mark, but there was some confusion between the terms excrete and secrete.

03.2 This levelled response question required students to make links between the immune response in an animal (following vaccination), and the prevention of a food poisoning outbreak in humans. The high demand required to enter level 2 resulted in less than 6% of students making the leap, with just under 62% of students failing to even enter level 1, thus gaining no credit.

For many students lack of adequate technical language was a barrier to gaining credit with vague statements eg the body or immune system makes antibodies or the body can react faster when the bacteria re-infects. Common errors included poor understanding of what memory cell specifically are – suggesting they act as antibodies, or that antibodies make white blood cells. There appeared to be less confusion about the difference between antibodies, antitoxins and antigens than in previous years. The 2% minority of students who were able to answer both parts of the question skilfully gained full marks in level 2.

03.3 It was encouraging to read that most students had experience of the practical, allowing over 70% of students to gain 1 or more marks. Although many students gave precise answers, ‘sterilise equipment’ or ‘flame equipment’ was deemed too vague at this level.

03.4 This question proved a challenge for the majority of students, with only 1% gaining the full 3 available marks, and just under 43% gaining no marks at all. Very few students identified 37°C as being human body temperature, perhaps thinking this was unnecessary or assumed. Some responses identified the potential growth of harmful bacteria but did not specify that it may be harmful to humans in relation to the 25°C being used in school laboratories.

03.5 Generally well answered with around 66% of students gaining the mark. The incorrect term ‘control variable’ was not infrequent.

03.6 75% of students gave a correct answer here. Where students failed to gain this mark, it was often due to a lack of precision in their response, with a lack of a comparative term or weak description of the area where bacteria had been killed. Some students were unsuccessful as they referred to just one of the antibiotics, and the question clearly asks why should either A or B be prescribed so both had to be included in the response.

- 03.7** Generally well answered with most students being able to make an attempt at the answer, and around 56% of students gaining credit. Where students failed to gain this mark, it was often due to a lack of precision, for example simply referring to the circle rather than the clear area or the area where bacteria had been killed.
- 03.8.** It was pleasing to see over 66% of students giving correct responses as they were clear on the idea of developing resistance. Numerous students muddled resistance and immunity and some commented that animals become immune to antibodies and as such could not be credited. Sadly, some students correctly described the development of resistance but went on to negate the mark with comments such as 'now the bacteria are immune to the antibiotic'.
- 03.9** This high demand question was not accessible to most students, and indeed over three quarters of students failed to gain any marks. Many students simply rewrote information from the stem of the question without saying that this was due to pressure from water and linking it to the impact this had on either the cell wall or cell membrane. A sizeable minority thought that the antibiotic entered the bacteria by osmosis causing it to burst. As anticipated some students negated correct detail on water movement, by giving incorrect definitions of osmosis, and in particular incorrect references to water potential or diffusion gradients. If water concentration is not specified, it is assumed that solute concentration is being described and this often results in an incorrect answer (for example, 'water moves from an area of high concentration to an area of low concentration' is not correct). We continue to also see confusion regarding the role of the cell wall and cell membrane in a cell, as well as lack of understanding around the role antibiotics play in bacterial infections.

Question 4 (Standard, standard/high and high demand)

- 04.1** Students were asked to explain two effects of anaerobic respiration on the body. Over 87% of students scored some marks on this question but only around 12% managed to score full marks. Many students mentioned lactic acid and were able to put this in the context of oxygen debt or muscle fatigue, though some answers were vague and referred to pain, aches or stitch which were not deemed sufficient to gain credit at this level. Lots of students gave increased breathing and heart rate as effects but less were able to relate this to the reason of needing the oxygen to break down lactic acid. Oxygen debt was frequently referred to but only gained credit as an explanation if reference was made to it being repaid in this context. While a significant number of students referred to 'less energy' being available, very few students correctly linked this idea to 'weaker muscle contractions'.
- 04.2** This levelled response question required students to design an investigation to show the effects of different exercise on heart rate. Most students attempted an answer, seemingly familiar with such an investigation. Over 16% of students were successful at entering level 3, with around 32% reaching level 2. The main barrier to students achieving higher marks seemed to be using just one athlete for the investigation which then limited the maximum mark achievable, as this would not lead to a valid outcome. Most understood the importance of measuring heart rate before and after exercise, although some students forgot about measuring the initial heart rate first, which again would not lead to a valid outcome. There were many references to technology such as heart rate monitors or watches to measure heart rate, which was creditworthy as long as heart rate was recorded before and after exercise. Students were generally very competent at describing control variables for their investigation.

- 04.3** Nearly 58% of students managed to gain the first marking point about anabolic steroids making athletes faster or stronger, or gave specific descriptions of improved performance or enhanced stamina. Only 6% of students also gained the second marking point, and were able to develop this and explain that the increased muscle mass caused more or stronger muscle contractions. Students must take care not to repeat information in the question stem without adding value to this; thus, an answer stating that anabolic steroids improve performance was insufficient.
- 04.4** Over 92% of students correctly identified 'hybridoma' as the type of cell created when a mouse lymphocyte and tumour cell combine.
- 04.5** The process of creating monoclonal antibodies is clearly well known by some students, though others have varied misconceptions including that the lymphocyte or monoclonal antibodies are cloned, rather than the hybridoma. Just under 3% of students were able to get the full 3 marks as a result.
Many students spent a lot of their answer describing that a hybridoma is formed when a mouse lymphocyte and tumour cell combine, but this gained no credit as it had been assessed in the previous question, and so wasted time and answer space. Very few described that the hybridoma is cloned (simply dividing by mitosis was frequently stated but gained no credit). Additionally, very few were able to describe that all the cells produced made the same antibody. The most common point made that gained credit was that monoclonal antibodies need to be purified after collection. This question was set at high demand and required correct use of terminology, which very few students were able to do; consequently, almost 59% of students scored zero marks.
- 04.6** Almost 90% of students were able to correctly identify that a monoclonal antibody only binds to the anabolic steroid.
- 04.7** Around 47% of students were able to correctly suggest the purpose of the control area in a test strip, and suggested that it was to show that the test had worked. Some were distracted into giving other irrelevant details of the test process here and discussed the complementary nature of monoclonal antibodies, rather than focus on the question posed.
- 04.8** Many students were able to give correct evidence with 58% gaining 1 mark. Sadly, less were able to suggest a possible reason for the evidence they had selected and consequently, only around 26% of students successfully gained both available marks. Some students referred to other processes involved in the test when discussing the reason, rather than focussing on the idea of monoclonal antibodies not binding to, or reaching, the control area. Lots of students described the test not being used properly, or the urine not having any steroids in it as their reason, neither of which gained credit.
- 04.9** Just over 75% of students correctly identified athlete D as testing positive for anabolic steroids.

Question 5 (Standard, standard/high and high demand)

- 05.1** The majority of students answered this question correctly with just over 68% of students gaining credit. A number of students referred to 'communicable disease' or 'carrier' which were not creditworthy.

- 05.2** Students were told in the stem of the question that the malarial protist is a eukaryotic cell, and clearly most students processed this information and just under 95% of student gained some marks. Incorrect responses were seen often when students mixed up protist and prokaryote structures or had misconceptions regarding prokaryote structure suggesting a lack of cell membrane or cytoplasm.
- 05.3** Most students gained credit for stating that less oxygen could be carried by the blood, if red blood cells burst. Only around 20% of students linked this idea to respiration and energy release for the second marking point. Some students suggested that as a result 'no oxygen would be carried' which was not creditworthy. We again this year saw the usual incorrect idea of energy being produced or created which lost students this second marking point.
- 05.4** Over 70% of students were able to gain some marks on this question, with 8% gaining the full 3 marks available. Many students knew that sexual reproduction involved 'gametes' but they failed to include the idea of fusion and missed out on the first marking point. A pleasing number of students gave the idea of genetic variation for the second marking point, but when 'genetic' was omitted or students simply referred to 'clones' credit was not awarded. The full array of possible creditworthy ideas were seen, as well as the fallback mark.
- 05.5** Only around 37% of students gained this mark. Those that did not, often lacked detail in their answer. Students were required to specifically refer to DNA, and terms such as 'chromosome' or 'genetic material' were ignored. Furthermore, references to DNA 'multiplying' or 'reproducing' did not gain credit.
- 05.6** This was a high demand question, and in particular the first marking point proved a good discriminator with very few students referring to 'one set of chromosomes' being pulled to each end of the cell, and instead giving vague references to 'chromosomes pulling apart', or 'DNA halves' which are insufficient at this level. While the process of mitosis is undoubtedly familiar to most students, they struggled to articulate their ideas clearly in their responses. Less than 3% of students gained all 3 marks as a result. Almost 37% gained 1 mark for references either the 'nucleus dividing' or 'the cell membrane / cytoplasm dividing' to form 2 cells.
- 05.7** The majority of students got muddled with the data in this question or misinterpreted it due to misreading the information provided in the stem informing them that 'the incidence of malaria in children with disorder S was calculated as a percentage of the incidence in children without disorder S'. Consequently, most students concluded that that having disorder S *increased* the chances of children getting malaria and therefore only a minority gained credit, with only 1% of students gaining 2 marks. The trend was however described correctly by around 27% of students for the whole age range obtaining 1 mark.

Question 6 (Standard, standard/high and high demand)

- 06.1** This question was well answered, with just over 87% gaining the mark. It is particularly pleasing to see that students are taking care with the size of the letters in chemical formulae and the correct use of subscript.
- 06.2** Almost 83% of students correctly identified 0 to 5000 lux as being the correct representation.

- 06.3** While many students had the idea to use some form of coloured transparent material to change the colour of the light shining on the leaf discs, unfortunately, some of those students didn't state where this material should be placed, which was in this case critical to gain credit. Also, some suggested just using a different filter with no reference to changing the filter's colour, and again could not be awarded the mark. Over 61% of students did however, give a correct reason.
- 06.4** Around 20% of students correctly named at least one of the variables, and a further 67% correctly named both variables. A large number of students chose to give the full headings from the table which secured them the 2 marks. Some errors commonly seen were giving the independent variable as the rate of photosynthesis rather than the time for the discs to rise, or indeed naming the two variables the wrong way around.
- 06.5** While expressed in many ways, just under half of students recognised that the leaf discs would float straight away if they still had air in them, and thus gained the mark.
- 06.6** The majority of students struggled with this question, and almost two thirds scored zero marks. A common misconception seen was students trying to link their answer to osmosis. To gain credit students needed to convey the idea that carbon dioxide could be provided or produced by the sodium hydrogen carbonate, and not simply that it contained it, which saw some students miss out on the mark. To gain two marks, students needed to develop their answer further to link the carbon dioxide provision to photosynthesis. Only around 13% of students were successful in this and gained the full 2 marks available.
- 06.7** Over 58% of students scored some marks in this question, and most commonly for indicating that oxygen was produced during photosynthesis. There were many vague ideas given for the second marking point with students simply stating 'the discs floated', without explaining a possible cause for this. Over 40% gained neither of the marks.
- 06.8** Most students could interpret the graph and could identify that each chlorophyll absorbed some *different* wavelengths, but they failed to explain the advantage of this in terms of the combination of chlorophyll a and b collectively being able to absorb more or many wavelengths of light. Vague responses such as 'more light absorbed' was commonly seen and did not gain credit without reference to colour or wavelength. Only around 41% of students gained this mark.
- 06.9** This question proved a good discriminator with only 5% of students gaining the full 4 marks, and over a third of students gaining zero marks. Students did make a good attempt at this question however, failure to use good biological terminology often prevented them from gaining either of the first two marks (or the fallback) because they failed to mention it was *chlorophyll* that was responsible for absorbing the blue/green light. Similarly, many students also failed to link the colour of light and the time for the discs to rise with a *change in rate of photosynthesis*.

The 25% of students that gained just 1 mark, most commonly gained credit for correct use of data. For this marking point students had to use both Figure 10 and Table 5, and many of the successes were seen linking a correct figure for either the peak percentage of blue light absorbed, or the minimum percentage of green light absorbed. Some ignored the instruction to refer to Figure 10 and Table 5 and only quoted values from Table 5.

Mark Ranges and Award of Grades

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