Questions matter

GCSE

Biology

8461/1H Paper 1 Higher Tier

Report on the Examination

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General comments

Mathematical skills shown across the paper were generally strong and students scored well on drawing a bar graph and a tricky question on magnification. However, the conversion of units, for example from millimetres to nanometres, is a skill that many students continue to find difficult.

Across the board, students' lack of understanding/acknowledgment of command words often meant that irrelevant detail was included in responses, such as those for questions 02.3 (enzymes levelled response), 04.5 (mitochondria in phloem), 06.2 (bacterial resistance), 07.1 (photosynthesis in leaves practical) and 07.8 (explaining a graph showing limiting factors). When the command is 'explain', a description is simply not enough and when the command is 'describe', explanations are unnecessary and will not lead to credit. Some students are also unable to adequately 'compare' when required to do so, stating that, for example, with three pieces of data, that one is 'lower' than the rest, but not using the description 'lowest'.

The understanding of osmosis was weak in some cases, as was understanding of the concept of bacterial resistance. A large proportion of students were unable to independently write a meaningful risk assessment for a Required Practical Activity (food tests, question 03.1), but many were able to both describe the correct food tests for starch and sugar, and plan a simple practical on osmosis. The question on digestive enzymes was not answered well. Exploring this area of the specification in different contexts will help students have greater opportunities to apply their knowledge to unfamiliar situations.

On occasions, some students wrote excessively; the answer space provided has been specifically designed to fit the responses of most students. In addition, when students use additional pages, all question parts should be numbered accurately. Students who use a word processor for all or part of their answers should ensure each item has been numbered correctly. In such situations, it is assumed that the writing beneath the question relates to that part and therefore, may not gain credit unless it is made explicitly clear which question part the response refers to. Students who use a word processor for all or part of their answers should also check that each item has been numbered correctly.

In a number of cases, the use of poorly phrased sentences and imprecise language lead to a lack of clarity in some responses. Students should be encouraged to read back over longer written responses to check for errors and ensure that their meaning is clear. There were several instances of students not reading the question carefully enough, or in calculations, not checking all of the instructions had been followed at the end of the answer.

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.

Questions 1 and 2 are common with questions 7 and 8 on the Foundation Tier. These questions are identical with each other and are targeted at standard demand.

Question 1 (standard demand)

01.1 93% of students selected the correct answer in this question.

01.2 50% of students achieved one mark in this question, with 38% gaining full marks. Many students believed that the principle reason for putting pressure on the heart was to restart the heart first and then to get the blood flowing generally to the lungs to get rid of carbon dioxide and to collect oxygen.

01.3 Three quarters of students answered this question correctly. Of those that did not, the idea of forcing air into the lungs helping to restart breathing was often given, but with no link to carbon dioxide triggering breathing to restart.

01.4 75% of students were able to recall the term 'statins' from the specification, with a small number giving incorrect answers such as 'blood thinners', 'insulin' or 'anti-cholesterol drugs'.

01.5 Nearly three quarters of students achieved full marks in this question. Of the 20% that scored one mark, most did not elaborate on the idea of the vessel being wider and therefore, that more blood could flow.

01.6 50% of students gained no credit in this question and found making conclusions based on the results in Table 5 difficult. The data showed to what extent the percentage risk of getting four different cardiovascular diseases increased as a result of smoking when compared with people who had never smoked. As a result, all conclusions had to reflect both the increased risk and its association with smoking. They also needed to be comparative, either on the basis of one disease over all others, by using words such as 'most' or 'least', or on the basis of one disease over one other by using words such as 'more' or 'less'. Answers invariably failed to match all of these requirements. Some students also mistakenly believed that the results reflected the 'risk' or 'danger' of the diseases rather than the risk of 'developing' them. Other answers revealed the misconception by some that the letters E to H referred to individual people rather than to the different diseases.

01.7 Students' graph drawing skills were generally good, with 84% of students achieving full marks in this question. In the 12% of responses that scored three marks, the most commonly omitted feature was the *y*-axis label, and some students truncated their label so much as to omit the reference to 'risk', which was not creditworthy. Students should be reminded to ensure that they use a ruler for graph drawing, as a number attempted to draw their bars freehand, resulting in missing out on credit due to inaccuracy.

01.8 68% of students answered this question correctly. The most common incorrect answers were those that lacked qualification, such as references to 'drinking alcohol' or to 'eating fatty foods', which needed the added idea of consumption of these being 'high'. Obesity was a common incorrect answer; it is not a lifestyle factor.

Question 2 (standard demand)

02.1 Most of the students who gained this mark (93%), identified 'nucleus', with many also suggesting 'chromosome'. 'DNA' formed part of the response for a significant proportion of students, but this was often associated with either of the two acceptable answers, so credit could be awarded. Very few students gave alternative components of a cell.

02.2 98% of students identified organs A, D and E as being the lungs, small intestine and pancreas.

02.3 This extended response question provided students with the opportunity to express their knowledge of the enzymes produced by the pancreas and how the products of digestion are used within the body. However, as this question was phrased in the context of a person with cystic fibrosis, marks could only be gained by students who described the details they had revised not occurring. Thus, those who only described what normally goes on in the body without any indication that in this context, these processes would not occur or would be reduced, could not gain credit. Students went about describing their answers in two ways: either giving the details they knew, followed by a statement that these processes would not happen or happen less, or by describing each step in terms of reduction (eg 'less amylase is produced so less starch is digested into glucose').

Lower-attaining students often got no further than repeating the details they had been given; 'less of each enzyme, so less digestion occurs', was a common response by many students, although they often repeated this in multiple ways to fill up the available space. It was also noticeable that lower-attaining students got no further than repeating the information in second bullet point from the question and did not attempt to respond to the command word of the question, 'explain'.

Although knowledge of the enzymes and their actions was generally good, the impact their lack would have on the body's ability to gain mass was less well understood. Few students referred to respiration, energy or the reasons why amino acids are needed by the body or cells. However, many did describe the reduction of absorption, often including the products of digestion in this story, and so could gain access to Level 3 as they had answered both parts of the question. Many students' answers lacked precision, describing the lack of absorption of starch, fat or protein, rather than of the products of the digestion of these large molecules, whilst others went on the describe the egestion of non-digested molecules; neither of which idea was creditworthy.

Those who only gave an answer to one side of the question (almost always the difficulty digesting food), however detailed this was, could not score higher than a mark in Level 2. Hence, students should be reminded, once they have completed their responses to questions such as this, to re-read the question, to ensure they have answered all parts of it.

Less than one third of students scored full marks in this question, with 13% scoring zero.

02.4 This question was generally well answered with nearly 50% of students gaining at least two marks. Despite the command word, 'describe', many students also added explanatory detail, often regarding diffusion in some way, but as the question did not ask for explanations, these were ignored. A 'large surface area' and a 'good blood supply' were frequently given. However, having 'thin walls' or having 'walls only one cell thick' was often poorly expressed, with answers implying that the alveoli themselves were thin or that they have a thin membrane; neither of which are correct. A few students drifted into an insecure knowledge of plant cell structure, describing the presence of 'thin cell walls', which was also not creditworthy.

It is a long-held and often repeated misconception that the alveoli being moist aids gas exchange. This is not correct and did not gain credit, although if included in an answer with three creditworthy points, was ignored.

02.5 Students could tackle this question in either of two routes: the reduction in (aerobic) respiration and its consequences or the occurrence of anaerobic respiration and its consequences. For many students, their responses contained elements of both routes, in which case the description which gave the higher mark was credited.

It should be noted that a reduction of oxygen supply will not stop (aerobic) respiration occurring altogether, so students who described this idea could not gain credit for this first point, although they might still have scored full marks for descriptions involving anaerobic respiration. In describing either route, 'tiredness' and 'fatigue' were common suggestions, however, without further qualification in terms of 'muscle' in the anaerobic respiration route, could not gain credit. Lower-attaining students gave descriptions which contradict the principle of conservation of energy, suggesting that energy is produced, rather than being transferred or released. Others suggest that energy is used *for* respiration, rather than being released by respiration.

27% of students scored full marks in this question, 35% scored two marks, and 22% one mark.

Question 3 (standard and standard/high demand)

03.1 In this extended response question, students were asked to describe two food tests and formulate a risk assessment for their method. It was clear that the majority of students understood this Required Practical Activity, however, some students mixed up the reagents, with a number suggesting that Biuret solution should be used to test for carbohydrates.

In order to achieve a mark within Level 3 (which 16% of students did), students needed to plan a method that would work, and hence, Benedict's reagent needed to be heated (to an appropriate temperature) or boiled, and the iodine used needed to be in solution, rather than a solid.

In addition, a clear risk assessment was required, and this is where the majority of students fell down. Risk assessments often lacked detail, with few students correctly identifying a hazard specific to the tests being described and even fewer giving a valid control measure. The majority of students listed generic lab safety rules such as 'wear goggles' or 'tie hair back' but did not link these steps to the method being used. It was clear that students knew many good practices in lab safety, but often failed to link the control measures to a risk in the food tests they described, or gave vague / incorrect descriptions of the risk, which were insufficient. A number of students did not include a risk assessment at all.

56% of students achieved a mark within Level 2 and 18% within Level 1.

03.2 83% of students were able to identify the independent variable in the investigation in this question. The most common incorrect answers simply stated 'time', which unqualified, was not creditworthy.

03.3 82% of students were able to identify a control variable the student should have used in the investigation, with the size/mass of bread being the most frequently seen correct answer. Students often did not achieve the mark because they gave variables that were already being controlled, such as the shape of the bread.

03.4 One third of students scored full marks on this question, and a further third scored two marks. Most students identified amylase as being found in the saliva and many could link this to the breaking down of starch into sugars. The majority of students did not identify the starch as being located in the bread and many referred to starch simply as 'carbohydrates' or 'the carbohydrate' rather than by name. Of those not achieving the third marking point, this was usually due to a lack of specificity in naming the enzyme, instead referring simply to 'carbohydrase'.

03.5 68% of students answered this question correctly, with the majority referencing the lack of repeats in the investigation, often by stating that 'it was only tested on one person'. A number of students were able to correctly use the term 'subjective'. Common incorrect answers seen referred to control variables, which students were specifically told not to refer to in the question, or an incorrect reference to bias.

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

04.1 Nearly 50% of students scored full marks on this question about plant tissues. Commonly seen errors included 'upper epidermis' for palisade (layer) and stomata or guard cells or stem cells for meristem. Occasionally, students named individual cells rather than tissues and lower-attaining students often misinterpreted the question and gave subcellular structures or transport tissues.

04.2 61% of students were able to identify lignin as a substance other than cellulose that strengthens xylem tissue. Occasionally, students gave an adaptation of xylem such as hollow or dead cells.

04.3 Nearly 80% of students were able to name 'translocation' as the method of transport of dissolved sugars through the phloem. The most common incorrect answers were transpiration, active transport, transportation and osmosis.

04.4 88% of students answered this question correctly.

04.5 This question saw roughly similar percentages of students achieving 1, 2, 3, 4 and 5 marks (roughly 15% per mark allocation). A number of students misinterpreted the question and listed what they thought the role of a number of other organelles was, in addition to the role of the mitochondria (which was ignored). Once students had made the link to the mitochondria, most were able to extend their answer to talk about the mechanism of active transport. Generally, there was a good understanding of energy being required for active transport, but not always a link to where this energy comes from. A significant proportion of students still describe energy being produced/made/created, which does not gain credit.

04.6 44% of students answered this question correctly. Of the incorrect responses, many simply included a description of the photomicrograph shown eg 'it has no nucleus', or 'it has a cell wall', instead of pointing out the loss or formation of structures ie the idea of a change. Pores in the end walls, formation of a cell wall, a larger vacuole and loss of the nucleus were the most common correct answers. Some students gave vague reference to loss of 'cell parts' and a common error was that the cell actually gains mitochondria. Descriptions of changes in cell size or shape were very common, but gained no credit.

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

05.1 In this extended response question, students were asked to plan a method that would have provided a valid outcome and allowed collation of the results shown in the graph provided. Whilst it was clear that many students had carried out this Required Practical Activity as part of their studies (with only 5% of students scoring no marks), many were not able to modify the method they had used personally to match what the question was asking. For example, many students incorrectly included information about how to calculate the percentage change in mass, and a number did not realise a mean mass change was required. As a result, a large proportion of responses were capped at Level 2 (70%).

15% of students achieved a mark within the Level 3 criteria, which required reference to more than two concentrations of solution with repeats and the calculation of a mean, alongside at least two control variables. Length was often referred to as a control variable, rather than mass or size, and was not credited. Another problematic control variable was the reference to the same amount of time. Many students incorrectly stated a submersion time of 5 minutes or less or used vague time periods such as 'a day' or 'overnight', all of which again, were not creditworthy.

05.2 The concept of the movement of water by osmosis remains one that students find difficult, with many not gaining marks due to including detailed or repetitive information that contradicts itself. Frequently, students missed out on credit by stating that water moves 'from an area of high concentration to low concentration' or 'from a high water concentration to a low concentration'. Weak articulated answers also often confused which molecules were moving, and some students believed that the salt or the entire solution moved out of the potato. Students using the terms 'concentrated' and 'dilute' generally made the correct link to the potato and solution.

35% of students scored full marks in this question, with 25% scoring two or zero marks, respectively.

05.3 This question was set a high demand and less than 10% of students scored full marks. 32% of students scored one mark. However, the concept of concentration gradients was relatively widely understood. For the first marking point, students often struggled to include both parts of the answer, stating either that 'the potato lost more mass' or 'more water left the potatoes', without linking the two ideas together. Many students did not use the data from the graph and instead talked about the potato in 1.0 mol/dm^3 *gaining* mass and some made up their own question, changing the concentrations they were comparing. As in question 05.2, a number of students talked about salt or salt solution moving, or about the potato needing or trying to balance out the difference. Others incorrectly referred to the salt or solution drying out the potato, which is a common misconception.

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

06.1 83% of students were able to name an appropriate antibiotic. Commonly seen incorrect answers included aspirin, ibuprofen and paracetamol.

06.2 65% of students scored one mark on this question, with the majority achieving the first marking point. 6% of students scored two marks.

The vast majority of responses referenced a zone of inhibition, rather than a description of an area where the bacteria had been killed, both of which were creditworthy. However, references to a 'clear' or 'white' area were not. A number of students missed out on the mark, however, for offering vague references to bacteria 'not growing' rather than describing the effect the antibiotic had on them. For marking point 2, the majority of students went on to simply repeat what they had said for marking point 1 in a different way; that because the bacteria were killed, or because there was a zone of inhibition, they cannot be resistant, rather than what would happen if the bacteria *were* resistant. Frequently, reference to the antibiotic being resistant was seen.

06.3 74% of students scored zero marks on this question, largely due to not accurately articulating their ideas. The most commonly seen response related to marking point 3, regarding the difficulty of developing new antibiotics in terms of cost or time, with nearly a quarter of students achieving one mark. Some students began a sentence about the difficulty of developing new antibiotics, but offered no further clarification and therefore could not be awarded a mark. For marking point 2, many students began to try to express the idea that diseases would become more common and/or diseases would be more difficult to treat. However, they struggled to articulate themselves in a way that was creditworthy, with the emphasis on (individual) illnesses or infection, rather than diseases generally.

06.4 36% of students were awarded the mark in this question. The majority of students were aware that viruses only exist inside living cells although many had difficulty expressing this clearly enough to gain the mark. The most commonly seen correct response referred to viruses needing cells to reproduce, rather than viruses *only* reproducing inside cells.

06.5 43% of students achieved the mark in this question. A significant number of students understood that drugs used to destroy viruses would also damage the body cells, with vastly fewer recognising that it was hard to get these drugs into cells. Those who did not gain credit for this idea often stated that 'antibiotics only kill bacteria', 'viruses are small, so are difficult to find' or 'it is hard/expensive to research and develop new drugs'.

Those student who referenced mutation usually did not gain credit because they described viruses mutating 'more' or 'faster', rather than frequently. Often, students used the term 'they' in their answer as referring to 'the drugs', when in fact 'they', in the context of the question, refers to 'the scientists'. Students should be encouraged to look at the subject of the question before answering in terms of 'they' or 'it' for example, or better still, not use such terms in their answer.

06.6 84% of students correctly identified AIDS as a viral disease that damages white blood cells.

Question 7 (standard, standard/high demand and high demand)

07.1 Most students were able to access this question on factors affecting photosynthesis, with only 12% scoring zero marks. 15% of students scored full marks, with the most common mark being 3 (achieved by 23% of students). Students who ordered their answer in the order that the leaves were given in the table tended to score more highly than those who gave a general answer about all three leaves mixed together. A number of students did not answer using an absolute, stating that no light meant 'less' photosynthesis or 'less' glucose produced, which is incorrect. A significant proportion of students explained that, in the absence of light or carbon dioxide, the leaf would break down the starch already present into glucose, therefore achieving the fall back mark for marking points 4 or 5.

Occasionally, students missed out on credit for good understanding of processes by using incorrect symbols for carbon dioxide, such as CO2, Co2 or CO^2. Students should be encouraged to write out chemical names in full where possible, to avoid this from happening.

07.2 85% of students answered this question correctly.

07.3 In this question, set at high demand, 56% of students scored zero marks, 33% scored one mark, and 9% scored two marks. Some students showed an understanding of the green part of the leaf containing chloroplasts, but did not go on to link this to chlorophyll, and thus did not meet the requirements for marking point 1. Although many students came close to achieving marking point 2, most lacked the complete answer referencing light absorption linked to an effect on photosynthesis and starch formation, which was required to achieve the mark.

07.4 87% of students were able to identify a correct ion in this question, with the most common responses being magnesium and nitrate. 'Nitrogen' as an incorrect alternative to nitrate was occasionally given by some.

07.5 Only 39% of students could recall the term 'chlorosis', with 'discoloration', 'lack of colour' or 'lack of chlorophyll' being the most common incorrect responses seen.

07.6 17% of students scored the mark in this question. Whilst most understood the idea of measuring the oxygen produced in photosynthesis, the majority were not specific in referencing volume and many did not refer to time.

07.7 19% of students gave a creditworthy response to this question. Students answered in many ways, often incorrectly stating that a limiting factor is one that would stop or decrease the rate of photosynthesis when in short supply, instead of stopping the rate from increasing.

A large proportion of students repeated the words in the question, saying 'it is something that limits the rate of photosynthesis', which was not creditworthy. Despite the use of the word 'rate' in the previous question, many students did not include it in their answer.

07.8 In this question, set at high demand, less than 11% of students scored more than one mark. 27% scored one mark and 67% scored zero.

A majority of students appeared to not acknowledge the command word and tended to describe the graph, rather than explain it. Students who answered this question in parts tended to score marking point 2 and marking point 3 more regularly than those who gave a general answer. Some students began to express their ideas about temperature and carbon dioxide concentration, but were unable to gain marks due to a lack of detail. As in other question parts, some wrote the symbols for carbon dioxide incorrectly, which was only taken into account once across the entire answer.

Marking point 1 was rarely achieved, with many students describing all four lines on the graph without comparing them. For marking point 4, students often discussed one (or more) of the rates reaching a plateau but did not discuss *all* of the rates. Those that did often disqualified themselves by writing that the plateau was where light became the limiting factor.

07.9 84% of students were able to identify the inverse square law.

Question 8 (standard, standard/high demand and high demand)

08.1 59% of students achieved the mark in this question, with most stating that the cell grows in size or increases its number of organelles. The increase in number was expressed in many different ways (replication, duplication, multiplication, etc.), all of which were creditworthy.

The most common incorrect answers contained descriptions of what happens during mitosis, such as the chromosomes being pulled to either end of the cell, or of the cell membrane and cytoplasm dividing.

08.2 78% of students answered this question correctly. The most common incorrect answers seen were cell wall and nucleus/nuclear membrane.

08.3 There were many ways in which students achieved a variety of marks in this question. 34% of students achieved 6 marks, and 33% achieved 5 marks, with the conversion from nm to mm being the difference between them. The conversion method was not well understood, with both divisions and multiplications with a large range of factors of 10 seen. Some students began by trying to convert the volume given in the question, which often led to further mistakes later on. Many students were able to substitute the numbers from the question into the equation given and calculate an answer, thus gaining two marks if they went no further (13% of students). Answers using any representation of *pi* (3.1, π or $^{22}/_{7}$) were accepted and seen, despite students being told to use 3.14 in the question.

Students could gain credit for quoting the magnification equation or for showing its use without writing it out in words. However, just quoting the triangular representation of the equation was not creditworthy. A significant minority of students gave the equation upside down and so were not awarded marking point 3 and, if they used it in that incorrect form, were not able to access marking point 5 or marking point 6, either.

08.4 47% of students scored no marks in this question, with 11% scoring full marks and 40% scoring one mark. A simple description of what normally happens during mitosis was not creditworthy, yet was seen regularly. Of the two marking points, marking point 1 was achieved more commonly than marking point 2. Where the mark for marking point 1 was not achieved, the most common errors included: a simple description of chromosomes not being pulled apart with no destination described; vague references to the edges/sides of the cell; or an implication that chromosomes were unable to move (unaided), rather than be moved. Attempts at marking point 2 were often too vague to be creditworthy, with a large number of answers just repeating that the cell couldn't divide, as was given in the question stem.

08.5 16% of students gained credit in this question and, as in question 08.4, a reference to what would be unable to happen in the situation described was required. Many students gave a simple statement linking cancer to uncontrolled cell division and those that went on to say that this could not happen often just paraphrased what had been written in the question, which was not creditworthy. Those that did score the mark mainly mentioned the prevention of the tumour growing, with a minority stating that secondary tumours would be stopped from forming. References to individual cancer cells rather than tumours were seen frequently and were not creditworthy. Some answers referred to preventing the formation of tumours rather than stopping the spread of tumours that were already there and thus did not answer the question.

08.6 83% of students answered this question correctly.

Mark Ranges and Award of Grades

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