Questions matter

GCSE

Biology

8461/1H

Report on the examination

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Overall Comment

Throughout the paper, students were able to showcase their AO1 knowledge well, but on occasion, ineffective articulation of language and a lack of biological detail meant that some AO2 marks were not achieved. This was seen particularly in the questions about respiration and fish gills. Many students struggled with the new context of a liver transplant and monoclonal antibodies, showing a lack of depth of understanding of the subject content, however, it was pleasing to see that many students were able to apply their knowledge of metabolism to an unfamiliar context.

From the required practical activities covered in this paper, it was clear that most students had gained working knowledge of the osmosis, amylase and pondweed investigations.
A number of students found the more unusual contexts provided difficult to understand for example, when analysing the colour changes of iodine solution or when looking at the time taken for pondweed to produce a set number of bubbles (likely the opposite to what they are used to). In these cases, some students disregarded their own knowledge about rates of reactions and stated erroneously that enzymes were denaturing at low temperatures or that rates were low at the optimum temperature. Many students were able to give accurate and detailed descriptions of how the osmosis method could have been improved, however, the majority neglected to acknowledge the command word 'evaluate' and thus could not achieve credit in Level 3.

The extended response question about liver disease was well attempted, however, a number of students answered in terms of a lack of digestive enzymes, possibly remembering (irrelevant) ideas from the question from last year's paper. The common misconception seen frequently year on year is that the liver produces lipase.
It was pleasing to see a large proportion of students making excellent attempts at comparing the three antibiotics in question 08.3, despite there being a lot of information to interpret.

The mathematical skills tested in this paper were widely understood by most students, and many were able to access full marks in some higher demand questions. However, a significant number of students struggled with the concept of calculating rate and determining the resulting unit. As in previous years, students' understanding and application of the magnification equation was strong, but conversion of units remains an issue for many, in this case, particularly as a conversion from cm to μm was required. The majority of students were able to round to 3 significant figures, but this became more problematic when students attempted to round decimal answers of less than 1. Graph drawing skills were generally strong, with students accurately plotting some difficult points. Lines of best fit still remain a source of difficulty for some students, with a number inappropriately drawing their line through the origin. When asked to complete a calculation using a graph, students should take care to ensure that they have read what is being asked of them carefully, and that they have

checked any values read from graphs are free from errors. A surprising number of students were unable to identify a scatter graph.

A large number of students continue to use the word 'it' in their descriptive answers when it is not always clear to what 'it' refers. Students are encouraged to ensure that they are clear about what they are referring to in such instances, despite this taking a little more time. Students should also be reminded to use comparative language when requested. Describing a value as being 'low' is not the same as it being 'lower' or 'the lowest'. When quoting raw data values from graphs or tables to support a conclusion this is unlikely to be comparative unless the word 'only' is used to show which value is lower.

As in previous years, common errors / misconceptions seen throughout the paper included reference to energy production (rather than release), carbon dioxide written incorrectly using symbols (for example, CO2, Co_2 or CO^2). Furthermore, the statements that in osmosis, water moves down the concentration gradient or from a high concentration to a low concentration are incorrect.

Most students found the answer space provided to be sufficient to structure their answers. However, students should be reminded that if they do use additional pages, all question parts should be numbered accurately. Students who use a word processor for all or part of their answers should also check that each item has been numbered correctly as there were a number of errors noted this year.

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 Over 80% of students gained credit for the answer of 'virus' in this question. Of the minority of incorrect answers, the most common was 'bacteria', followed by 'fungi', 'protist' and 'communicable'.

01.2 65% of students correctly stated how measles could be spread, but some referred more vaguely to 'direct contact' or 'through the air', neither of which gained credit. A few incorrectly believed that measles is a sexually transmitted disease.

01.3 Pleasingly, 85% of students were able to identify 'willow' in this question. A small number of students did not gain credit as they had included a second, incorrect answer alongside willow, such as foxglove.

01.4 90% of students achieved the mark in this question owing to the wide range of creditable symptoms listed in the mark scheme. Some students gave unnecessarily long lists of symptoms, which occasionally led to the mark being disqualified when symptoms such as nausea and diarrhoea were included.

01.5 Although students found this question accessible, very few (10%) managed to gain both marks. 45% of students achieved 1 mark, usually for the idea of herd immunity in MP1. Many students focused on how vaccination affects individuals, rather than the impact of vaccination on the population as a whole. This led to responses about personal immunity rather than a decrease in measles frequency at the population level. Occasionally, students stated that measles would not be passed on to the next generation, as if it was a genetic disorder. MP2 required the idea of reduced likelihood, chance or probability of measles being spread and not a simple rewrite of the question such as 'therefore spread would be reduced'.

01.6 90% of students scored full marks in this question. The most common error seen involved using data from more than one bar or calculating a percentage using values from two bars.

01.7 Most students made a reasonable attempt at this question, with those scoring marks realising that the data in the figure showed the percentages of vaccinated and unvaccinated children who all had measles, and the degree of severity of these cases. The data did not show information about the likelihood of the children catching measles in the first place. Students who achieved both marks (45%) typically used comparative language and precise data from the graph in one concise sentence. Terms like *only* were effectively used to emphasise differences, and some students successfully manipulated data to give clear, accurate responses. Those who achieved 1 mark had usually identified that vaccination reduces severity (MP1) whilst those that scored zero marks (31%) tended to give an answer which focused on the chance of contracting measles.

Question 2 (standard demand)

02.1 Nearly 80% of students gave a creditworthy answer to this question, very often by referring to heart disease or to Type 2 diabetes. Heart failure was considered too vague and did not gain credit. The most frequently seen error was one of omission when students simply suggested 'diabetes' without the qualification of 'Type 2'.

02.2 Nearly 60% of students achieved full marks in this question, with a further 32% achieving 2 marks. MP1 was occasionally missed due to labelling the axis with 'y' only, omitting to include 'arbitrary units' or the use of an incorrect scale. It was sometimes difficult to determine the plotted points in responses, because they were either far too small or far too large or were concealed by a very thick line of best fit. Students should ideally be advised to give clear crosses for plotted points and to draw graphs in pencil so that alterations can be made without any ambiguity. MP4 was usually awarded for a straight line which went through or between the majority of the plotted points, regardless of whether some of these had been incorrect. The most common error was to draw the line of best fit through the origin. It was rare to see students drawing straight lines between individual points but, where this alone was given, they did not match MP4.

02.3 77% of students answered this question correctly, with the most common incorrect responses including 'dot', 'line' or 'spot' graph, or references to conclusions in respect of correlations shown, such as 'directly proportional'.

02.4 99% of students gained credit in this question.

02.5 Over half of all students scored full marks in this question, correctly interpreting the results and using their knowledge of the starch test to explain the results shown in the table. A lack of acknowledgement of the command word (explain) and confusion over the colour changes at each temperature (thinking that at 30 °C, the enzyme was not working) were the most common errors seen. A small proportion of students incorrectly stated that iodine solution showed the presence (or absence) of both starch *and* sugar, or that the amylase itself was being broken down. Unspecific references to 'carbohydrates' in place of starch and / or glucose were not creditworthy.

02.6 53% of students gained credit in this question.

02.7 60% of students scored full marks in this question, with a further 28% scoring 1 mark, most commonly MP1. A substantial number of students gave their answers the wrong way around and the 'pancreas' was often chosen mistakenly in the context of being a site of production, rather than activity of, protease. Unqualified references to 'intestine' were frequently seen but were not credited and a number of students think that the liver is an organ that manufactures, and is a site of, digestive enzyme activity.

Question 3 (standard demand)

03.1 This was a levelled, extended response question based on a required practical. Students were asked to evaluate a given method to investigate osmosis in pieces of potato. Students achieving Level 1 (11%) made very few relevant points. Students achieving Level 2 (78%) suggested further improvements to the method and often gave reasons as to why these might be required, but judgements were always incomplete. Students achieving Level 3 (10%) made full use of the command word 'evaluate' and considered both strengths and weaknesses of the method in addition to indicating the ways the method could be improved.

Few students gave responses which allowed them to match the Level 3 requirements. Most omitted any consideration of strengths, and their judgements were incomplete. Many, nevertheless, seemed confident in their attempts at answers and this was pleasing to see.

The question asked for ways to improve the validity of results, and these needed to be clear. Discussion of controlled variables such as size, time and volume required quantification, or clarification that they needed to be the same or specific on each occasion, rather than just 'similar', 'recorded' or 'precise'. A large number of students suggested that the mass of the cubes should be kept the same, but this was neither plausible, nor required.

The use of specific pieces of equipment only gained credit if they were linked to clear improvements to validity. Several responses referred to the use of a cork borer to obtain cylinders of potato but then did not add anything about the control of length; others suggested the use of stop watches but with no link to control of time.
Points which were frequently seen from the indicative content included drying the cubes before measuring mass, repeats and calculation of mean values and the use of more different concentrations. Some students focused on aspects such as safety considerations, tables of results, graphs or explanations of osmosis. These were not appropriate additions to an evaluation, which asked for ways to improve the validity of results. Discussion of a 'wider range' of concentrations was only relevant if mention was made of 'more than 3' values within it.

03.2 39% of students scored the mark in this question.

03.3 This question asked for one way in which active transport differs from osmosis. It was most easily answered by one clear, distinctive point about active transport being given, without any further mention of osmosis. 82% of students achieved the mark in this question. For BP2, it was common for students not to gain credit for including incorrect biology when describing osmosis, for example 'active transport goes from low to high concentration, but osmosis goes from high to low'. Incorrect reference to particles moving from a low concentration gradient to a high concentration gradient were seen more commonly than in previous years.

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

04.1 89% of students were able to identify the independent variable in the investigation. The most common incorrect answer was 'time taken to release 10 bubbles', which was the dependent variable. Other incorrect answers seen included the type or length of pondweed. A small minority of students had misunderstood the practical or seemed to have seen pondweed and assumed it was an investigation into the effect of light intensity and therefore gave answers such as the 'distance of the pondweed' or 'the number of bubbles produced'.

04.2 In this question students were asked to calculate the rate of photosynthesis to 3 significant figures and to include the correct units. 30% of students achieved full marks, with 39% not scoring any marks at all. Many students identified the correct value of 43 seconds from the table and those who had read the information carefully realised that this was the time for 10 bubbles to be produced and continued to correctly complete the calculation. However, a frequently seen mistake was to use the value of 20 (°C) from the table in a calculation, and this was not worthy of any credit. Some students converted their answer to bubbles per minute and as long as this was given to 3 significant figures (14.0) and the units were correct, could achieve full marks. Also seen, although rarely, was a conversion to bubbles per hour and again, this could be credited with all available marks. Most students were correctly able to round their answer to 3 significant figures. However, many students struggled to identify the correct units, with common incorrect answers including cm^3/s, O_2/s or b/s (presumably trying to abbreviate bubbles to b, which was not worthy of credit). Students should be encouraged to work out units from the calculation they have completed.

04.3 The majority of students (59%) were able to gain the first marking point and state that the rate was higher at 40 °C than at 10 °C. The converse was also accepted. Few were able to explain why this was the case, although the majority of those that did, provided a good explanation in terms of increased energy of particles and more frequent collisions, and achieved the other two marks on offer (24%). Most students, however, went on to quote data to support their statement and this did not gain credit as it did not explain why the rate was higher. There were also some students that seemed to go on to make up their own question and explain what would happen if the temperature continued to increase, describing denaturation of enzymes. Some students attempted the correct explanation, however missed key details for the marking points, for example, stating that there is 'more energy' but not identifying that the energy is of the particles or reactants, whilst some stated that the pondweed as a whole had more energy. Others knew there were more collisions but missed that these are more frequent or more successful. Of the misconceptions seen, cells having more energy and chlorophyll being an enzyme were the most common. It was not uncommon to see confused accounts about the effect of temperature on the opening of stomata and a number of students confused photosynthesis with respiration.

04.4 79% of students scored full marks in this question. The full range of answers on the mark scheme were seen, with the most common being carbon dioxide and light intensity. Carbon dioxide was often given as CO_2. Students need to take care when giving the chemical formula for carbon dioxide as the 2 was occasionally seen superscript or the same size as the C and the O, which are both incorrect.
Other common incorrect answers were pH, surface area, concentration of solution or amount of oxygen. Answers affecting the rate of transpiration, e.g. humidity, were ignored and any suggestion that wind was a factor was not accepted. It was surprising to see a number of students giving temperature as an answer, despite being specifically told not to.

04.5 In this question, students were asked to give one way the method could be changed to obtain more accurate results. 18% of students were able to give a correct response to this question by identifying the equipment that could be used and how it could be used to collect the oxygen or measure its volume. Some got close to gaining the mark, however, only gave part of the answer required e.g. identifying that the volume needed to be measured but not stating which piece of equipment to use or using a measuring cylinder to collect the gas but forgetting that it needed to be inverted to do so. Another common omission was volume as 'amount' or 'how much' were too vague for the mark to be awarded. Occasionally, students did not achieve the mark due to reference to the incorrect gas (carbon dioxide), There were many others who purely gave general improvements to the practical, the most common being to carry out repeats and calculate a mean or suggesting variables that should be controlled and ensuring that no other factor was limiting. Another common suggestion was to use smaller intervals of temperature. A few even suggested a completely different investigation, changing the independent variable to the more familiar light intensity investigation and therefore changing the distance of the light. These ideas were not creditworthy.

04.6 Students were asked to describe two ways a gardener could identify a plant disease. This question discriminated well and all options on the mark scheme were seen. Only 27% of students scored full marks with 57% scoring zero. Commonly, students merely gave symptoms to look out for e.g. colour of leaves or drooping, but such answers were not creditworthy. The most common correct response was reference to a gardening manual or gardening website. A number of students gave both of these options but as they were the same marking point (involving the same idea of using a source), could only be credited once. Others were too vague to achieve this point with statements such as 'look it up', or Google it', without giving an idea of where or what was to be looked up. MP2 was also frequently seen, with students suggesting a sample of the plant could be taken to a lab for testing. MP3 was less frequently seen and often when students attempted this marking point, they just stated that a 'test kit' should be used and missed the idea of the kit containing monoclonal antibodies.

04.7 80% of students were able to identify rose black spot as the disease in this question. Some added the name of the pathogen to the end of their answer, which was still creditworthy, however, an incorrect pathogen such as a virus, was incorrect. Some students omitted the words 'black' or 'spot' from their answer and therefore did not gain the mark, but answers that omitted 'rose' were still considered creditworthy. The most common incorrect answer was Tobacco Mosaic Virus / TMV.

04.8 59% of students were able to gain full credit in this question by explaining why the plant developed yellow leaves. All options on the mark scheme were seen and the majority of students were able to gain a mark by identifying a shortage of magnesium ions and / or less chlorophyll. Simply stating that the plant has chlorosis was not sufficient for the mark; this needed to be linked to a shortage of one of the ions or a lack of light. Other students confused chloroplasts for chlorophyll or stated that chlorophyll was affected, but did not say how. It was not uncommon to see the idea of chlorophyll 'fading' or 'discolouring', neither of which was creditworthy. Those that started down the second route on the mark scheme often linked this to less chlorophyll, but this was insufficient – instead, students needed to state that the chlorophyll was being broken down. Another common incorrect answer was reference to TMV.

Question 5 (standard/high demand and high demand)

05.1 This question was generally well answered with 63% of students achieving the mark. Some students gave vague answers such as 'nutrients', 'waste' or 'carbohydrates', which were not credited due to a lack of specificity. These responses suggested a partial understanding but missed the precision required by the mark scheme. It was surprising to see a large number of students describing blood clotting, possibly confusing the word 'plasma' with 'platelets.

05.2 This question required students to recall and apply the magnification formula, including rearranging it, substituting values and performing unit conversions. Most students were able to correctly recall the full magnification equation rather than relying on symbols or triangle methods, which were not creditworthy. However, a common source of error was an incorrect rearrangement of the equation when solving for actual size. Additionally, a significant number of students struggled with unit conversion. While many recognised that 1 mm = 1000 µm, they often overlooked the need to first convert from centimetres to millimetres, leading to errors in the final answer. Despite this, many students made a good attempt (59% gained full marks and a further 32% achieved 4 marks), and it was encouraging to see clear working and structure in students' responses. Students should be reminded not to round their answers to calculation questions too early on in their working; as a number of students did so in this question, leading to an incorrect final answer.

05.3 Students were presented with a diagram of the heart showing four labelled blood vessels and were required to match labels to a pressure value. Most students were able to correctly identify that blood leaves the heart at high pressure and returns at lower pressure. Some also recognised that pressure in the pulmonary circulation is lower than in the systemic circulation. Where students had a secure understanding of the circulatory system, they were able to apply this knowledge effectively to select the correct values, with 66% achieving full marks, and 22% achieving 1 mark.

05.4 68% of students were able to identify vessel D as the pulmonary vein, suggesting a strong familiarity with the structure and function of the heart. Where errors occurred, they were often due to confusing the pulmonary vein with the aorta, with errors in both the side of the heart and the direction of blood flow.

05.5 This was a generally well-answered question, with 62% of students correctly describing artery walls as thick, muscular and / or elastic. A small number of students referred instead to the size of the lumen or the pressure of the blood, which did not gain credit as the question asked specifically about the structure of the wall.

05.6 63% of students scored no marks in this question, with the majority misunderstanding what was being asked of them, often describing the disadvantages of anaerobic respiration, rather than the efficiency. Therefore, those students who only referred to the production of lactic acid and its effects did not answer the question and so could not gain credit for this knowledge. Students who went into all the detail they knew regarding the comparison of aerobic and anaerobic respiration frequently gained the first mark (26%), as irrelevant information was ignored. Only 10% of students were able to access the second mark, realising that the word 'only', was critical to this approach. A number of students continue to refer to energy production or generation and some other common misconceptions seen included:

- aerobic respiration being quicker than anaerobic
- anaerobic respiration using more energy than aerobic
- removal of lactic acid requiring energy (and so anaerobic respiration being less efficient).

05.7 Most students who gained the first mark in this question did so by referring to 'oxygen debt'. 45% of students achieved 1 mark. Describing the presence of lactic acid in the blood was insufficient for this mark, as the figure shows there was always some lactic acid present. A number of students could link the concept of oxygen debt to this question but gave further explanatory detail showing that they did not understand what it meant, for example, incorrect ideas such as 'oxygen was used in the oxygen debt', 'the body needs an oxygen debt' and 'the oxygen debt is still required'. 34% of students scored full marks with the second marking point being more difficult to access for many, with some of these displaying a misunderstanding of the concepts described in the specification; in that oxygen is used to 'remove' or 'break down' lactic acid but is not used directly to rebuild lactic acid into glucose. A number of published texts only add to the confusion around this concept; the conversion of lactic acid back to glucose is an oxidation reaction (loss of electrons), but it does not require oxygen directly. Vague descriptions such as 'oxygen flushing out the lactic acid', 'limiting the effects of lactic acid' or 'neutralising the lactic acid' were insufficient. Some students thought that the body needed to aerobically respire in order to break down the lactic acid.

05.8 The answers from many students (58%) lacked the detail required to gain either mark, although it was clear that many of these students understood the overall advantage to some athletes of having a high number of red blood cells. Those students who did not gain credit often referred to the increased number of red blood cells being able to

carry more oxygen to the muscles in order for more respiration to take place to release energy.
These students had omitted reference to haemoglobin (for MP1) or to 'aerobic' or 'anaerobic' respiration (for MP2) and should be reminded to include all the relevant detail they have learned when answering any question.
Fewer students than in the past, now refer incorrectly to energy being 'produced' or to energy being used 'for' respiration, although a significant minority still do. Some students also think that oxygen binds to red blood cells to form haemoglobin.

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

06.1 This question was very well answered in a succinct way by 90% of all students. Occasionally, students omitted to refer to what was moving, and a very small number got the concentrations the wrong way around. It is worth reinforcing with students that the particles do not move from a high concentration *gradient* to a low concentration *gradient*. A significant number of students still included terms such as 'along the concentration gradient' despite this appearing as a frequent flag in previous examiner reports.

06.2 It was pleasing to see that students were able to attempt to apply their knowledge of the adaptations of the lungs to the diffusion of gases in the gills, with most students (nearly 40%) achieving MP1. It was not uncommon to see a long answer containing only descriptions of the gills, rather than explanations, and again, students are advised to acknowledge the command word for each question to ensure that they have included all of the relevant information. Occasionally MP1 could not be awarded where students simply copied the information from the question (gas exchange) rather than linking this to their knowledge of how the gases move. Less than 5% were able to score 3 or 4 marks due to a lack of specificity regarding the structures involved, often just mentioning gills, rather than the filaments within them. Whilst this was acceptable for MP1 and MP2, the higher demand marking points required a more specific description of the feature. There is a subtle difference between having a 'good blood supply' (number of blood vessels) and having a 'good blood flow' (speed of blood) and the insufficient reference to blood flow was a common reason why MP2 was not credited. The most common mistake seen for MP3 was reference to the 'gills' being thin, rather than the filaments, and without reference to the walls of these. As in previous years, occasionally, students confuse the walls of exchange surfaces with cell walls. Very few students accessed MP4 as their answer lacked the detail required at this level, but of those that did, a significant number made a very good attempt at describing counter-current flow linked to concentration gradient. Students should be reminded of the need for clarity and appropriate terminology in their responses. Reference to a constant or steady concentration gradient does not imply steepness, and 'a' gradient in place of a concentration gradient is insufficient. As in previous years, the misconception relating to 'moist linings' was frequently seen.

06.3 A range of marks were seen across this question, with roughly equal numbers of students scoring 1, 2, and 3 marks. 13% scored zero marks in this question. Of the marking points achieved, MPs 2 and 3 were the most commonly credited, with the most frequent omission being reference to movement – many students just repeated

the stem of the question and referred only to 'swimming'. It was pleasing to see only a small number of students stating that energy was produced, although some did state that energy is needed for respiration. MP3 required reference to 'more' respiration, and this was often inferred earlier in the student's answer. It would be beneficial for students to remember to repeat this idea at each stage of their answer i.e. more movement, requires more respiration to release more energy for more muscle contraction, to ensure that all marking points are achieved. Only a small number of students scored MP4. A number of students wrote in the converse, stating that there would be *no* respiration in a resting fish (the fish would be dead!) and a number used the incorrect word 'respirate' in place of respire. As in previous years, a small minority of students think that glucose is a product of respiration.

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

07.1 Nearly 60% of students were able to use the correct terminology to achieve the mark in this question. Common incorrect answers included referring to the process of differentiation as 'specialisation' or describing undifferentiated cells turning into specialised cells.

07.2 47% of students achieved the mark in this question, with the most common correct answer being the idea of embryos or a potential life being destroyed or killed. A smaller proportion of students achieved credit for the idea that embryos are unable to give consent but very few were able to articulate ideas about beliefs clearly enough to be awarded the third bullet point in the mark scheme. Incorrect responses were often less biological or were emotive in nature e.g. 'it's murder', 'a baby is killed', 'embryos are a potential life', and 'it would have grown into a baby', that did not answer the question.

07.3 62% of students scored full marks in this question, with a further 17% scoring 2 marks, and 9% scoring 1 mark. The majority were able to identify and spell hybridoma (for MP3) correctly, but credit could not be awarded for reference to cancer, rather than tumour cell (for MP2), and white blood cell rather than lymphocyte (for MP1). A small number of students incorrectly named cell A as 'spleen cell' and cell B as a dead or weakened pathogen.

07.4 42% of students scored the mark for this question with most referring to injection of antigens rather than liver cells. Incorrect answers were almost always related to injecting the mouse with a pathogen or disease, confusing this context with that of vaccination against infectious disease.

07.5 Around 30% of students scored a mark on this question with only 11% scoring 2 marks and 1% scoring full marks. MP1 was most frequently scored, with the statement that monoclonal antibodies bind to antigens (on liver cells). A common incorrect response was that the monoclonal antibody would bind to white blood cells to stop them rejecting the liver cells. MP3 was scored infrequently, mostly with the idea that antibodies made by the patient's white blood cells would be blocked from binding to the liver antigens, after MP1 had already been scored. A few students did correctly describe that phagocytes could not detect the liver cells as the monoclonal antibodies

were bound to the antigens on their surface. MP2 was very rarely scored. Whilst most students had attempted this question using some correct terminology, the responses were often confused and either showed that the information provided in the stem of the question had not been used, or that the student had misunderstood the nature of the monoclonal antibody treatment for liver disease. It was very common to see the idea that if the monoclonal antibody was bound to the liver cell antigens, that the white blood cells would not produce antibodies at all.

07.6 This question was well-answered by most students with 67% scoring the mark. A range of answers was seen, although responses relating to cancer detection and treatment were most common. Drug and COVID testing were also seen frequently. Most incorrect answers were due to students not fully qualifying their responses for example 'treat diseases' or 'fighting cancer'.

07.8 This was a levelled response question about the function of the liver during liver failure. The majority of students attempted the question, but 43% of students achieved no marks. Level 2 responses were the most common with 24% of students achieving marks. 11% of students achieved Level 3 and 20% Level 1. The majority of Level 2 responses that did not match the criteria for Level 3, were due to an omission to refer to the role of lipase, or to distinguish that the rate of breakdown of fats would be slow*er* with liver disease. In addition, students were limited to Level 2 if they only described the effect on emulsification **or** on the neutralisation of acid.

In Level 1, the majority of students did not develop their answers, scoring 1 mark for reference to the effect on emulsification and neutralisation, but with no further detail, or scoring 2 marks for a linked idea about either emulsification or neutralisation. Common misconceptions included lipase being made in the stomach, fat *molecules* being broken down by the process of emulsification (rather than by lipase action), the liver producing lipase and bile neutralising acid in the stomach. Other incorrect answers included the idea that there would be no digestion of fat without bile, that lipase is found within bile, that bile is an enzyme and that lipase engulfs fats. The context of many students' responses related to the usual role of bile in a healthy liver, whilst mentioning less bile production in patients with liver disease. Some students scored no marks for this approach as they did not reference the disease causing less bile production, or said that the patient had *difficulty* producing bile, which was not creditworthy. Occasionally, some students did not mention bile at all, despite it being in the stem of the question. A few students thought that the diseased liver would stop producing enzymes or lipase which is why digestion of fat was difficult.

Question 8 (standard/high demand and high demand)

08.1 90% of students achieved the mark in this question.

08.2 This question was answered well with 82% of students achieving 2 marks and less than 2% scoring zero. All three of the possible answers were seen, with vacuole sometimes being correctly qualified as 'large' or 'permanent'. The most common uncreditworthy

answer was 'ribosome' not being qualified with 'large'. Some students also gave chloroplasts as an uncreditworthy answer, with a few stating 'cell wall'.

08.3 This was a levelled response question with the command word compare. In comparison to question 03.1 where students struggled to evaluate, the vast majority were able to make valid comparisons in this question. The majority of students (59%) gained 2 marks as there were many routes to achieve more than the minimum requirement to enter Level 1 without giving enough detail to enter Level 2. Those who were able to enter Level 2 most commonly had given enough supporting evidence to gain 4 marks (11% of students). Most students were able to identify A as the least, and C as the most effective antibiotic and give supporting evidence from the graph for those comparisons. They often also stated or implied that the effectiveness of B was 'in between' but were limited to Level 1 because they did not give any explicit evidence for this, most commonly just describing the line for B, without including comparisons with A and / or C. 16% of students gained zero marks. These students had usually misinterpreted the graph completely, getting the comparative order the wrong way around. Others did no comparisons, but just described the three lines, and so students should be reminded to pay attention to the command word in the question. A few disqualified themselves by contradicting statements they had made by using the wrong letter for the antibiotic, possibly by accident. This may have been corrected if they had read their answer back through. There were some answers that were very difficult to read due to illegible handwriting at this late stage of the paper, but the majority of students found the answer space sufficient, not needing to use additional pages.

08.4 57% of students scored no marks in this question and, of those that did, the majority achieved MP2 only**.** Very few students realised the need to dilute the samples in order to be able to count the bacteria and therefore, MP1 was awarded very rarely. Students were more successful with MP2, with both routes to carry out the calculation seen. Many students gave a method to calculate the mean (which was not necessary for the mark to be awarded), and also the correct multiplier for the mean. Some students referred to scaling up the individual counts and then calculating a mean. This is a valid way of getting the correct answer, so was also creditworthy. The most common reason for students not to be awarded MP2 was the counting of just one sample and then scaling that up. Some students referred to multiplying by 50^3, presumably assuming that volume was important in some way, and a few more referred to measuring the area of the bacteria rather than the number, presumably confusing this question with the required practical and questions in previous years.

Mark Ranges and Award of Grades

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