



GCSE

BIOLOGY

8461/1F Paper 1 Foundation tier
Report on the Examination

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General comments

There were seven questions on this paper, two of which were common with the GCSE Biology Paper 1 Higher 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. Question 5.9 exemplified this in particular.

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 two levels of demand for this paper:

- **Low demand** questions are designed to broadly target grades 1–3.
- **Standard demand** questions are designed to broadly target grades 4–5.

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 (Low demand)

01.1 Over 70% of students correctly selected the leaf as the largest part of the plant.

01.2 Students were asked to calculate a mean and nearly 75% were able to do this correctly. Errors included multiplication (rather than addition) of the three numbers before dividing by 3, and the selection of tests 1 and 2 only, reflecting the anomaly in the 3rd test for concentrated salt solution. Students are always asked to show their working out and if this was correct, but linked with a final wrong answer, one mark could still be awarded.

01.3 Almost 6% of students did not attempt this question possibly because they did not read the instruction and missed the mark unintentionally. Answers that ambiguously showed a ring around more than one result failed to gain credit.

01.4 Two thirds of students were able to gain the mark here. Some failed to answer the question, however, which specifically asked for what they should do with the result when calculating the mean. The idea of doing another test was clearly inappropriate. Others gave general descriptions of how to work out mean values; others suggested using a figure of 0.7 (the mean of the first 2 tests); others attempted to 'explain' the anomaly instead. None of these answers gained credit.

01.5 A pleasing number of students correctly identified the control variable here, with around 40% of students missing out on the mark.

01.6 Only 20% of students failed to identify the variable that students kept the same as 'Time in the salt solution'.

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- 01.7** Almost 80% of students knew that osmosis was the process described.
- 01.8** Over 85% of students knew that some particles can pass through a partially permeable membrane.
- 01.9** Over two thirds of students correctly identified ‘use more concentration of salt solution’ as a means to improving the investigation.

Question 2 (Low demand)

- 02.1** Nearly all students were able to determine ‘pathogens’ as being the name given to microorganisms that cause disease.
- 02.2** Almost 90% of students correctly linked both defences to the part of the body that provided the defence. Students should be reminded that they must not draw more than one line from a box on the left in these questions, as this will not gain credit.
- 02.3** A pleasing 90% of students knew that a tumour can form when changes to cells cause uncontrolled cell division.
- 02.4** Students have a clear understanding of features of malignant tumours, and indeed only around 4% of students gained zero marks on this question. Almost two thirds of students gained both available marks.
- 02.5** Over 95% of students gained this mark. A number went on to use data in support of their statements but this was not necessary. Some simply said that Table 2 showed that ‘the vaccine had worked’, but as the question asked specifically about how the **percentage** of females with HPV had changed, no credit could be given.
- 02.6** Surprisingly, only around 42% of students could suggest a correct reason for the change in HPV cases from 2010-2016. Many of these students correctly referred to more females, and sometimes more males as well, being vaccinated. Those failing to gain credit however, often simply stated ‘vaccination’ as the reason but gave no idea as to why the percentage continued to fall over time.
- 02.7** Nearly 80% of students knew that white blood cells respond to an inactive virus, and gained the mark.
- 02.8** While the most common incorrect answer was ‘antibiotics’, it was pleasing to see over 93% of students correctly identifying antibodies as being produced in response to the inactive virus.
- 02.9** Most credited responses here were around concerns of side effects from the vaccine and this was expressed in many different ways. Around 60% were in fact successful in gaining the mark. Reference to ‘anti-vax’ parents was seen but unless qualified as to the reason behind refusal to vaccinate it failed to gain a mark. Many students correctly quoted religious or cultural objections although, ‘religion’ or ‘beliefs’ on their own were insufficient. The idea that the vaccine might simply not work was commonly credited but answers such as ‘parents are scared of the vaccine’ or ‘it’s too expensive’ gained no marks.

Question 3 (Low and standard demand)

- 03.1** It was pleasing to see that over two thirds of students could demonstrate sound recall of the equation for photosynthesis and gained all three marks. Glucose was sometimes incorrectly given as a reactant, and protein or fat occasionally, as a product.
- 03.2** This question proved a challenge for many students, and many attempted to explain how the oxygen might enter or be carried by red blood cells, rather than how it is used by cells. Answers such as this gained no credit, and almost 60% of student gained zero marks. While some correctly mentioned 'respiration', only 10% of students went on to discuss the resultant release of energy for the second mark. Incorrect responses which suggested that energy could be 'made' were less obvious than in previous years. Several answers referred to respiration occurring in mitochondria and this was given credit for two marks.
- 03.3** It was very pleasing to note that students are acutely aware of health and safety issues in practical work. The hazards and risks in this question were in the context of an investigation into light and photosynthesis. Credit could not, therefore, be given to the idea of harmful liquids splashing into eyes as only water was used. Neither were marks awarded for the idea that the light in the experiment could damage eyesight. Almost 36% of responses seen gained both marking points, with reference to possible burns from hot bulbs being the most common. Those who mentioned broken glassware often failed to gain two marks by failing to go on to suggest that this might lead to cuts of the skin. Other weak responses just mentioned possible electrocution without giving a clear linked hazard.
- 03.4** This question proved a good discriminator, with only around 22% of students gaining the mark. Many vague responses were seen, for example, keeping the apparatus in the same room each time the experiment was carried out, and others believed that the beaker of water should be heated with a Bunsen burner. Some students said that they would keep a check on the temperature by using a thermometer but failed to give any idea of what should be done if this temperature changed. Good answers referred to use of a water bath or an LED bulb. Credit was given to the idea of insulating the beaker provided that the material used, if mentioned, would still allow light through.
- 03.5** Students found it hard to express their ideas when answering this question, and consequently just over half of students failed to gain either available marking point. Responses that did not gain credit included – 'to make the experiment fair', 'to make sure everything was accurate', 'to keep the results the same all the time', 'because the pondweed could die if it got too hot'. One mark was given for acknowledging that temperature affects photosynthesis in some way, and where students gained only 1 mark, it was usually for this idea. The second part of the explanation, however, that this would then affect the actual results obtained was less frequently seen.
- 03.6** Almost all students that attempted this question, correctly chose the colour blue.
- 03.7** A little over two thirds of students were successful in identifying a bar graph, as being the best way to display the results.
- 03.8** The majority of students failed to name a piece of apparatus used to measure the volume of oxygen produced. Around 30% of students gained the mark, and indeed the use of a measuring cylinder was the most common response.
- 03.9** Over two thirds of students gained the first mark here by correctly stating that as light intensity increased, the rate of photosynthesis did the same. A few failed to gain credit as they gave

the relationship the wrong way round, thereby implying that an increase in photosynthesis caused the increase in light. Only 10% of students gained the second mark for the increase of both being at the same rate as each other. A few incorrectly suggested that the rate was 'constant'.

Question 4 (Low and standard demand)

- 04.1** Nearly two thirds of students knew the term 'vector' correctly describes the mosquito.
- 04.2** Although the question states that Figure 2 showed a (single) cell of a malarial protist, some students remained confused and believed that there were 'cells depicted within a cell'. Others incorrectly discussed the absence of plant cell features, such as 'no chloroplasts', while others got prokaryotic and eukaryotic cells muddled. Reference to size was ignored. While 25% of students failed to gain any marks, the most frequently seen correct feature was 'nucleus', followed by 'mitochondria'. Phonetic spellings were obviously allowed as students have difficulty in spelling both of these words. As in all questions of this nature, the 'list rule' applied so that where a student gave 3 answers, 2 of which were correct and 1 wrong, only one mark could be given.
- 04.3** Over two thirds of students gained the mark by selecting *Salmonella* to be prokaryotic. While the remaining students indicated 'cow' or 'grass', in equal amounts.
- 04.4** Around 77% of students knew that asexual reproduction involved only one parent.
- 04.5** It is clear that many students still remain unclear about the number of chromosomes involved in mitosis. Only around a third of students correctly selected '14' as the number of chromosomes each new protist cell would have after mitosis. The most common incorrect answer seen was '28', which was selected by a further third of the students.
- 04.6** Around half of students were correct in selecting 'decreased haemoglobin' as a change that would happen in the blood of a person with malaria.
- 04.7** Nearly 35% of students who are adept at mathematics found this question very straightforward and an easy route to four marks. A further 31% managed three marks, via many routes, but most commonly by reaching the point of 350 million but then failing to convert to standard form or incorrectly doing so. Others forgot that the question referred to 'millions' of people being infected and used 105 and 315 but, nevertheless, an answer of 3.15×10^2 was still awarded three marks.
- 04.8** Many students were aware of what should be done to reduce the chance of being bitten by mosquitoes but then used inadequate scientific language to express themselves and as such only around 13% of students gained both available marks. Answers such as 'cover yourself up' or 'use bug spray / repellent' were not credited. 'Wear more / thicker clothes' was also deemed insufficient and 'close windows / doors' also failed to get credit without qualifying that this was only important in the evenings. Some correctly suggested not going to places with mosquitoes or where there was an incidence of malaria and a few answers referred to destruction of breeding grounds. Other correct suggestions were also awarded credit, but overall 42% of students scored zero marks.
- 04.9** Nearly three quarters of students gained one mark here for correctly describing that the chance of getting malaria decreased with age. A few incorrectly understood the context of disorder S, however, and said that the likelihood of having this, rather than malaria, was lower as age increased. Even though the instruction given in the question was to use data

from Table 4 only around 10% of students went on to gain the second mark for an appropriate use of figures. Some, unfortunately, glanced too quickly at the results and believed there was a decrease of 5% every 2 years.

Question 5 (Low and standard demand)

- 05.1** This question asked why a person needs new cells. The context was of mitosis but many students lost this focus. Although many referred to 'growth' some failed to give complete answers by focusing only on the fact that 'cells die', and not go on to say that new cells had to be made to **replace** these dead cells. Other vague responses included, 'to keep us alive' / 'to fight disease' / 'to keep us healthy' / 'to get stronger'. The mention of 'protein' in the question stem also led some to mistakenly bring 'denaturation' into their responses. Nearly half of students articulated themselves adequately to gain the mark.
- 05.2** Over 67% of students knew that proteins were made from amino acids.
- 05.3** Students continue to be confused between the Benedict's reagent and Biuret reagent, and this was shown here with more than half of students failing to select Biuret as the correct answer.
- 05.4** Over half of students knew that purple was the colour seen in a positive test for protein.
- 05.5** It was pleasing that over three quarters of students gained two marks here for correctly linking the characteristic of enzymes, with the effect on its function. Students should be reminded that they must not draw more than one line from a box on the left in these questions, as this will not gain credit.
- 05.6** The majority of students were able to identify the optimum pH for enzyme Y using the graph provided. Of the 16% who did not gain credit, they were often only marginally out of the accepted range.
- 05.7** This question was in the context of a graph (Figure 3) showing the rate of protein breakdown by two enzymes in respect of pH. The ability to process and understand this data discriminated well between students, with only just over 16% of students gaining 2 marks. Good answers described how enzyme X worked best at pH 2 (or in low pH or acidic conditions) and then explained that this was the same pH level as that found in the stomach. Some students incorrectly stated the enzyme itself was acidic. The first marking point was only awarded if students understood from the graph that the enzyme worked best / maximally / optimally at pH 2. Comparative words such as 'better' or 'faster' were insufficient. Knowledge of acid being present in the stomach was more evident but this was then often linked with confusing statements such as 'so enzyme X will neutralise the acid'. The fact that the graph showed breakdown of protein by a second enzyme Y led some to mistakenly think that they had to compare the two. The question context of digestion and pH confused others who drifted into discussions of amino acids / fatty acids. Students should be advised not to refer to 'it' in answers except where there can be no ambiguity. In this question 'it' could have meant either enzyme X or the stomach. Just under half of students scored zero marks for this question.
- 05.9** This levelled response question required students to describe a method to investigate the effect of pH on the rate of starch breakdown by amylase, based on the required practical activities 4 and 5 in the specification. It was hoped that the procedures involved in the investigation would be familiar to students but many struggled with writing clear and coherent

answers. It was very evident when students had been exposed to the required practical activities, and indeed almost 15% of students did not even attempt a response, and a similar percentage scored zero marks.

Figure 4, showed some of the apparatus used as an aid to help students in their responses. It was evident, however, that many were unfamiliar with spotting tiles, and mistook them for test tube racks or otherwise believed that the ‘dimples’ could accommodate large volumes of solutions. Required practical activities include the use of appropriate equipment. In this case, appreciation of how to use a pipette, a measuring cylinder and a timer, as shown in Figure 4, could have earned credit in answers. Answers could have been given in bullet point or numbered form – in fact, this method might well have helped students organise their thoughts.

Only around 1.3% of students achieved 5 or 6 marks, showing clear, logical sequencing of the investigation and evidence of how valid results might have been obtained.

Level 3 students routinely included reference to:

- appropriate mixing of amylase, pH and starch solutions
- timed additions of the mixture to iodine solution
- recorded time for the mixture to remain orange
- repeated experiments at different pH levels
- evidence of at least one variable having been controlled

Just under 16% of students gave a level 2 response, where students included mention of appropriate mixing of amylase, pH and starch solutions as well as referencing repeated experiments at different pH levels.

The majority of students gave answers that matched a level 1 response only. Marks within level 1 were dependent upon the degree to which indicative content points were mentioned. Students very often managed to achieve 2 marks by simply referring to the use of equipment given in Figure 4.

Question 6 (Standard demand)

06.1 Whilst most students could describe a tissue as being ‘a group of cells’, with many of these going on to state that these cells were ‘working together’; this was insufficient for credit. Further qualification in respect of the cells being ‘similar’ or of the cells ‘having a particular function’ was required to gain this mark. Thus, relatively few students were rewarded. It was evident that some students struggled, as ideas such as tissues being ‘parts of organs’ were not uncommon. Almost 79% of students failed to gain the mark.

06.2 Many answers referred to parts of the plant, such as xylem or root hairs. Knowledge of ‘meristem’ as being the tissue in plants where stem cells are found was by no means widespread. Some students had not read the question carefully enough and suggested animal tissues, most commonly ‘bone marrow’. Just over 10% of students knew that meristem tissue contains stem cells and gained the mark.

06.3 A wide variety of plants were suggested, along with some suggestions of plant tissues and even fictitious plants such as ‘the aspirin tree’, perhaps as students struggled to recall the answer and had been trained to write down something, rather than nothing – that said, 17% of students did not attempt a response at all. Of the plants given in responses, ‘willow’ was

by far the most common and gained the mark for over 18% of students. Others such as 'foxglove' were mentioned, indicating a recollection of plants named in the specification.

- 06.4** Many answers simply repeated information given in the table, such as 'berries have the least mass of the chemical', but this was not sufficient as it does not explain why the berries are picked in preference to leaves or roots. Vague answers such as there being 'more berries' were also insufficient to gain credit. Around a quarter of students gain the mark, with common correct answers referring to the idea that picking berries would not harm the plant, that berries would be 'easier to collect' or that 'the chemical would be easier to extract'.
- 06.5** Relatively few students managed to complete the calculation correctly, with only 4% gaining all 4 marks. The most common error was by students who did not know the conversion factor for grams to milligrams. Fortunately, this usually only cost students 1 of the 4 marks, as answers which had used the incorrect conversion factor (whether this involved multiplying or dividing by an incorrect multiple of 10) were still able to gain the final mark. Students often got only part way through the calculation, stopping at 0.72 or 2.4, for 1 mark only; however, the 3rd and 4th marking points could still be gained if correctly addressed. Some students divided values, rather than multiplying, as was needed, whilst others arrived at somewhat unlikely answers equivalent to many hundreds of grams, far exceeding the 200 g mass of plant tissue it was extracted from. Nearly half of all responses gained no credit – either because it was not attempted – or completely incorrect.
- 06.6** Around 30% of students gained the mark in this question. A lack 'of magnesium' or 'of chlorophyll' was quite well known and many students gained this mark. Answers often implied a degree of speculation by students, but those who did attempt an answer may have been rewarded for this, as, for example, a lack 'of light' or of water' were both credited. A description of 'an infection' along with naming any plant disease also gained credit, as students are not expected to know, for example, that the tobacco mosaic virus does not infect nightshade plants. A not infrequent suggestion was that having chlorosis would 'put animals off from eating them', as students interpreted the question as asking for an advantage of having chlorosis, rather than what had caused the condition.
- 06.7** There were many good answers to this question, with frequent references to toxicity, dosage and efficacy. Some students, though, offered two ideas relating to toxicity, with descriptions regarding safety and side effects: thus, gaining only the one mark. However, over 90% of students gained some marks in this question, which was pleasing.
- 06.8** Many responses referred to writers of the report, or companies who might want the public to use or avoid the drug, however relatively few references to one party or another making financial loss or gain were made and as such only around 10% of students were awarded the mark. Other insufficient responses referred to ethics of using plants or the possibility that habitats might be destroyed by large nightshade plantations. Students only needed to refer to people 'buying' or someone 'selling' the product, to gain the mark or alternatively the idea that the writer of the biased report might have been 'paid' for their work.
- 06.9** Nearly 64% of students correctly indicated that scientists should 'have the claims peer reviewed' to be sure claims are valid.

Question 7 (Standard demand)

- 07.1** Nearly 44% of students could identify part A as the part that received oxygenated blood from the lungs.
- 07.2** Around quarter of students could identify part C as the part that pumps deoxygenated blood to the lungs.
- 07.3** Approximately 35% of students could identify the right atrium as the part where the pacemaker was found.
- 07.4** This question was generally attempted well with all of the marking points seen, and just over 38% of students scored the full 2 marks, and a further 22% scoring 1. A common error seen was to fail to use comparative language, for example 'artery has thick muscle' or 'vein has wide lumen'. 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.
- 07.5** 80% of students were able to describe the trend well, and indeed it appears students are more prepared than in the previous years to describe a trend. Many students did so by using the whole of the headings from the table columns in their answers. A minority of students gained the mark by using the term 'inversely proportional' or 'negative correlation' but this language was rare. Some students negated a correct description of the trend with an incorrect term.
- 07.6** Only around 6% of students did not attempt to construct the graph, and as such many of the students that attempted gained some marks, with almost 65% scoring 3 or 4 marks. The scale mark was frequently awarded with only a few students squashing it into less than half of the grid available or using strange intervals with a significant number having non-linear scales. The points were well plotted in more than half of responses, 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. By far the main stumbling block seemed to be the student's ability to draw a reasonable line of best fit 'free hand', with many still joining point-to-point with a ruler. 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.
- 07.7** Nearly 44% of students found identifying the correct value at 35 from their own graph challenging and failed to gain the mark. However, over half of students were able to read accurately from their graph even if their line had not been creditworthy. Some effectively drew construction lines but other attempts were in the wrong place, reading from 25 or 30 on the x-axis.
- 07.8** This levelled response question required students to explain the effect of a partly blocked coronary artery on the human body. This proved a very challenging question for the majority of students, but proved a very good discriminator with only around 1% of students reaching level 3. Over 10% of students made no attempt at this question, whilst a further 20% of students failed to score any marks. Answers generally lacked the specific biological detail required in order to gain marks. Consequently, the majority of student responses were seen at level 1, with around 55% of students gaining 1 or 2 marks. The lack of understanding about the position and function of the coronary arteries was evident, and 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. Other students referred only to what normally happens rather than what is happening in this scenario and there were many lengthy responses that mentioned little that was creditworthy apart from a heart attack.

07.9 Almost 30% of students achieved 2 marks on this question, with the most common route to doing so via reference to stents. These students could usually name them (and describe how they are fitted) although some did have to rely on describing them. Statins were also often seen although often without gaining the explanation mark as they were often described as being able to remove / breakdown existing fat deposits. On the rare occasion reference to 'bypass' was encountered, it was generally described quite well along with some reasonable descriptions of how it worked. The most common errors were seen when students opted for surgery to physically open the vessel to remove the blockage. Over 13% of students did not attempt this question, which could be an indicator they ran out of time.

Mark Ranges and Award of Grades

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