GCSE

BIOLOGY

8461/1F: Paper 1 – Foundation
Report on the Examination

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General

In the second year of the new specification for GCSE Biology, most students coped well with the demands of the paper and there was little evidence to suggest that students were unable to complete all questions within the allotted time.

Lower-attaining students did not attempt the final three questions on the paper, which were common to both the Foundation and Higher tiers. Students should be encouraged to at least read through these questions and attempt as many as possible, rather than leaving them blank.

On occasions, some students wrote excessively and should be reminded that the answer space provided has been specifically designed to fit the responses of most students. Several students used additional pages for just one or two words; centres could advise students to only used additional pages when absolutely necessary. In addition, when a student completes a graph on an additional page it is essential that graph paper is used, as plotting marks cannot be awarded when a grid is not evident. The addition of a scale is also very difficult to award a mark for unless the student carefully draws this. Even with additional graph paper, the student should lay out the dimensions of their graph in the same way as in the original question. To avoid the need for additional paper in graph drawing questions, students should be advised to use a pencil so that corrections can be made easily.

Some students' handwriting was particularly difficult to read and the use of poorly phrased sentences and imprecise language led 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 incidences 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. In multiple choice questions, occasionally students did not read the instructions fully and gave either too many or too few responses.

The basic mathematical skills tested in this paper were widely understood by most students, however, a significant number were unable to read values from a graph accurately, or plot an even scale and axis. Many students failed to achieve a mark when asked to draw a line of best fit and therefore, students should be exposed to a variety of graph drawing experiences that involve both curves and straight lines of best fit. At this level, a large proportion of students had difficulty manipulating decimal numbers smaller than 1, often omitting zeros in their answer. Several students were also unable to convert cm to mm, another skill that requires practice.

From the Required Practical Activities (RPAs) covered in this paper, it is clear that students continue to struggle understanding the concept of a control experiment, frequently confusing this with a control variable. Students' explanations of how to make the results of an investigation more valid continue to be somewhat ineffective. Many students struggle to articulate their ideas in a different context, hence, it is vital that students have the opportunity to carry out all RPAs within the specification throughout their GCSE course.

The cell drawing question identified the need for students to practise this skill more frequently as most students' drawings did not closely resemble the figure provided. Students' labelling skills also need work; many labels ended before the cell itself or did not touch the labelled structure.

In extended response questions, many students were unable to articulate themselves accurately when comparing bacterial growth. However, the 'describe' question on body defences was

generally well answered. Many students continue to simply copy information or data from the question given when asked for more detail, which gains no marks.

Levels of demand

Questions are set at three 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 Nearly all students were able to use the pie charts to answer this question correctly.

01.2 Around 71% of students correctly identified the percentage of water found in beans using the pie chart.

01.3 Most students could access the mark here but some imprecise language meant that students' meanings were often unclear. General comments about beans having a more balanced amount of everything were insufficient to gain the mark and some students made reference to beans simply having 'all four', but did not clarify what the four were.

Most students could interpret the charts given but did not choose the most obvious omission of carbohydrates in chicken, and so compared the quantities of fat/water/protein, which were not creditworthy.

Comments about other missing nutrients such as fibre were also not creditworthy as these were not given in Figure 1.

01.4 Around 69% of students correctly identified amylase as the enzyme that breaks down starch.

01.5 Half of the students were able to identify the chemical that tests for glucose.

01.6 Many students showed a good knowledge of the range of colour changes possible with Benedict's reagent and several made a list of all of the possible colours. This was acceptable unless other incorrect colours such as black or violet had been included in the list.

01.7 Nearly all students achieved this mark.

01.8 Around 84% of students were able to identify the small intestine from Figure 2. Most incorrect responses either gave the wrong organ, particularly the large intestine, or the intestines unqualified.

01.9 Over half of the students gained both marks in this question. It was common to see students selecting the two correct terms, but using them the wrong way round.

Question 2 (low demand)

02.1 Around 78% of students were able to identify the correct definition of diffusion.

02.2 Many students only used the first route here. They often failed to identify a feature for marking point 1 eg 'projections on the gills' but gained credit for 'larger surface area' for marking point 2. Others referred to 'gaining more oxygen' but without stating how this was achieved. Lower-attaining students referred to the gills as moving the axolotl through the water.

02.3 Around 58% of students were able to identify the process of differentiation in this question, with the most common incorrect answer being adaptation.

02.4 Three quarters of students were able to name mitosis as the process by which the stem cell divides.

02.5 Around 59% of students achieved this mark.

02.6 Nearly all students gained one mark in this question and nearly 58% achieved full marks for identifying two advantages of using axolotls in stem cell research.

02.7 Half of the students were able to identify D as the part of the lungs where oxygen enters the bloodstream.

02.8 Half of the students were able to identify part E as the trachea or windpipe. Several students spelling of trachea was incorrect and oesophagus was a common incorrect answer. A few students referred to the air pipe which was not creditworthy.

02.9 Around 63% of students achieved this mark for identifying which blood vessel carries blood to the lungs.

Question 3 (low & standard demand)

03.1 More than a fifth of students achieved full marks on this question, with three quarters of students able to correctly complete at least one sentence.

- Many students think that the waxy cuticle is made of cells, often giving this answer for the first sentence.
- Very few students knew that photosynthesis occurred in the palisade mesophyll, often giving epidermis as their answer here.
- It was common for students to confuse xylem and phloem in the third sentence.

03.2 Three quarters of students were able to identify the guard cells as controlling the width of the stomata.

03.3 More than half of all students were able to identify the function of the stomata.

03.4 Around 46% of students were able to identify evaporation as the process by which water is lost from a leaf, with respiration being the most common incorrect answer.

03.5 Around 56% of students were able to analyse the graph correctly and access both marks.

Some students did not read the labelled axes and scales carefully enough and so did not gain credit. A significant number of students calculated the water loss at 3 hours, indicating that they had not read the question carefully enough.

Several students struggled to use the scale given for volume of water lost and assumed each large square was equivalent to 1 cm^3.

03.6 Half of all students gained the mark in this question.

03.7 Many students gave acceptable comparative reasons. However, several students gave 'the temperature changed' as an answer, which was not comparative and therefore not creditworthy.

Several students struggled with the concept of humidity, with 'more humid' being a common, incorrect answer.

03.8 This question was extremely well answered, with most students easily accessing marking point 1. Many gave very detailed descriptions of the consequences of the spikes/thorns to animals.

Question 4 (low & standard demand)

04.1 Around 31% of students were able to correctly identify one control variable in the investigation, and nearly 58% identified both.

04.2 About 89% of students correctly identified value X by reading the measurement from the measuring cylinder in Figure 8.

04.3 Approximately 56% of all students could identify the gas that caused the foam to rise.

04.4 The vast majority of students identified the straightforward relationship ie one in which an increase of both of the factors was described. There were very few students who only quoted one end of the relationship such as 'the highest mass of sugar gives the greatest volume of gas', which was insufficient.

04.5 Many students did not access this marking point, referring to sugar being needed for the reaction. Very few students realised that this reaction was respiration or that sugar or glucose was needed for respiration. More general answers were given such as sugar being necessary to produce foam, with no indication that respiration was taking place.

04.6 Students generally understood that the measuring cylinder with 0 g of sugar was needed to prove that sugar was required for the foam to be produced. Students articulated this in a variety of ways, including as a control or as a baseline.

However, there were a significant number of responses that referred to fair testing, accuracy and reliability, which were not creditworthy. Some students occasionally stated that the measuring cylinder was a control variable, highlighting the frequent confusion between this and a control experiment.

04.7 Unlike answers seen in question 04.5, many students did mention respiration here, but then failed to express that the layer of oil prevented oxygen getting through to the yeast. Other non-creditworthy answers were more general in nature, including stopping gases getting out or stopping carbon dioxide from escaping.

04.8 Around 47% of students correctly identified the product of anaerobic respiration in yeast.

Question 5 (low & standard demand)

05.1 Around 80% of students identified gonorrhoea as causing the man's symptoms in this question.

05.2 About 60% of students gained this mark for why antibiotics did not cure the man's symptoms.

05.3 Less than half of the students showed sufficient understanding to gain this mark. In the vast majority of cases this was by referring, in a variety of ways, to avoiding intercourse; with fewer students suggesting the need to wash hands after using the toilet.

However, some responses were too vague to gain the mark, including 'washing hands' without the necessary qualification as to when or 'avoiding physical contact' without identifying the specific type of contact that should be avoided. Although complete isolation would avoid the problem, this was also considered to be too vague.

There were a number of answers, such as 'sneeze into a handkerchief' that indicated students had failed to read the question carefully enough and apply their knowledge to a new situation.

05.4 This was an extended response question based on RPA 2 as outlined in the specification. There was a good spread of marks across the range available and the question differentiated between students well. As it was an RPA students should have, therefore, been familiar with the procedure involved and how the results could be assessed. They were asked to compare the effectiveness of three antibiotics at killing three different types of bacteria.

The first hurdle to overcome was being able to distinguish between the antibiotics and the bacteria. Students who rushed their answers without carefully absorbing the information in the stem of the question often confused the numbers of antibiotics with the letters of

bacteria. It was not uncommon to see antibiotic A and bacteria 1 being referred to in answers. It was impossible for examiners to give credit for such statements.

Some students seemed to misunderstand the layout on the plates, believing that the inhibition zones were places where bacteria were actually growing, in spite of the labels given, or where the antibiotic discs had 'expanded' into. Others looked at step 4 in the method, saw the word 'repeat' and seemed to think that all three plates were, in fact, repeats using the same bacteria each time.

A few students were completely confused and thought that the investigation was testing the effectiveness of the bacteria in 'overcoming the antibiotics'. They decided that bacteria C must have been the best as there was no clear area at all around antibiotic 3.

Secondly, students needed to compare the effectiveness of the antibiotics. Comparisons always require words such as 'more'/'less'. Those students who hedged their bets by writing, for example, 'pretty effective'/'slightly effective' failed to achieve many marks. Students achieving Level 1 identified some relevant features and differences between the plates. The statements they made were only qualitative and offered little in the way of clear comparisons of either one antibiotic across all three types of bacteria or all three antibiotics on one type of bacteria.

Students achieving Level 2 identified clear differences of effectiveness noted the magnitude of these differences and discussed them in an appropriately scientific fashion. The statements they made were both qualitative and quantitative. This should not have been too difficult a task if they had carried out a similar practical during their studies. The statements did not need to be long or complex and it was not necessary to include all of the points listed in the indicative content on the mark scheme to achieve the highest level.

Neither did responses have to be written in complete sentences - succinct bullet points would have sufficed. They did, however, have to reflect at least some quantitative comparisons between either the individual antibiotics across all three types of bacteria or the three different antibiotics on the individual plates.

A number of students measured the diameters, or even areas, of the inhibition zones to reinforce the comparative points they were making. As thorough as this was, it was not necessary to do this for maximum marks to be awarded. Some students also realised that bacteria C was resistant to antibiotic 3 but many still confused 'resistance' with 'immunity'.

05.5 Nearly all students identified the correct milk sample in this question.

05.6 Around 87% of students gained both the marks in this question. Many students showed the complete working as advised on the front page of the question paper while others showed part of their calculation, perhaps only the raw values from the table. In this latter case, provided the correct answer was given, both marks could be awarded. However if the answer was incorrect, neither mark could be awarded.

There was the occasional suggestion that students had determined the median value, but unless this was entirely obvious, students were given the benefit of the doubt and marks were awarded accordingly.

05.7 This question differentiated between students very well. The scaffolding allowed lower-attaining students to access the stages in the calculation. Many students used the scaffolding well and arrived at the correct answer.

Standard form was used in many cases. Where a student made an error in one part of the calculation and then the error was used in a correct method to calculate the next step, this second mark could be awarded.

05.8 Around 88% of students gained this mark for identifying which milk sample could not be sold to humans to drink.

05.9 There were various ways in which students could gain this mark. Students could approach the question either in terms of the consequences of drinking such milk or the reason why they should not. Thus, answers such as 'because you would get ill' or 'so you won't get ill' were both acceptable. However, vague answers such as those referring to 'harm' or 'danger' were considered to be insufficient. Around 72% of students achieved a mark here.

Question 6 (low & standard demand)

06.1 In addition to the acceptable responses of cardiovascular, circulatory or circulation system, students also incorrectly identified the heart as belonging to the respiratory system. There were a wide range of student responses where the heart was identified as belonging to the breathing system, the organ system, the blood system, the body system or the heart system. Some students also linked the circulatory system and the respiratory system by identifying the heart as belonging to the cardiorespiratory system.

06.2 Around 58% of students were able to identify and draw a ring round a valve in the heart accurately. However, several students incorrectly identified one of the arteries or veins entering or leaving the heart as a valve.

Frequently, the ring drawn by students was unnecessarily large and incorporated other irrelevant structures within the heart and thus could not gain credit. A further fairly common and inappropriate response from students was for them to only circle a single element of the valve rather than both elements.

06.3 Two fifths of students were able to identify that the valves in the heart prevent back flow or ensure one-way flow of blood. However, many students indicated that the valves were involved in 'pumping' blood one way around the body or that they 'squeezed' the blood through the heart. Other non-creditworthy responses were of a more general nature, making reference to valves 'letting blood into and letting blood out of the heart'.

06.4 About 36% of students were able to identify the type of blood vessels containing valves as veins. A number of students actually named a specific vein that contained valves.

Several students incorrectly identified the type of blood vessel containing valves as pulmonary (unqualified), aorta, capillaries, atria, or red blood vessel. A notable number of students were not able to offer a response to this question.

06.5 The general response given by students was that the mechanical valve would not need replacement after five years, rather than it being **less likely** to need a replacement. Many student responses were of a general and unqualified nature, making reference to the mechanical valve being made out of metal and plastic. Few made reference to the mechanical valve being longer lasting, more durable, or not breaking or tearing.

Many students made appropriate reference to the ethical issues involved in using a biological valve from a pig. References to a mechanical valve removing the risk of rejection or there being no need for immunosuppressant drugs were also given by a few students. References to immunosuppressant drugs were not always clearly stated with general reference being made to having to take less medicine the norm.

Around 6% of students achieved full marks and around 47% of students gained one mark.

06.6 About 1% of students gained the mark in this question. Students were asked to suggest one reason why a patient may choose a biological valve from a pig and not a mechanical valve. Responses to this question were almost exclusively related to there being 'no risk of blood clotting'. The fact that there is no need to take anti-clotting medication if a biological valve was chosen was rarely encountered. Some students did go further to say that clots could be fatal or cause 'problems', but did not give sufficient further detail to achieve the mark.

Some students, after noting that there would be no risk of blood clotting did correctly go on to link this to a reduced risk of heart attack or stroke. Other acceptable suggestions such as not being able to hear the pig valve, getting a better fit or fewer leaks with a pig valve were not seen.

06.7 Less than half of the students achieved two marks on this question, and nearly 41% achieved one mark. Generally students followed the instructions given well and drew only two lines from the boxes on the left, as instructed.

The most common correct answer seen was the link between an irregular heart rate and artificial pacemaker. The most common incorrect answer seen was high blood cholesterol being treated using insulin.

Question 7 (standard demand)

07.1 Three-quarters of students answered this question correctly; however, the term 'powerhouse' of the cell was not creditworthy. Some students gave answers such as 'carries the instructions for the cell' which were deemed to be too vague.

07.2 Around 66% of students were able to name either a red blood cell or bacterial/prokaryotic cell as containing no nucleus. Xylem cell was rarely seen, however, eukaryotic cells and

plant cells were common incorrect answers. Occasionally, students failed to qualify the type of blood cell they were referring to and hence, did not achieve the mark.

07.3 This question was designed to assess students' scientific drawing skills, as outlined in RPA 1. Very few students drew a cell of a similar shape to the one in Figure 12, instead drawing simple round or oval cells. Some students failed to read the instructions carefully and drew a plant or bacterial cell, and some did not draw a cell at all, instead labelling the parts of the cell shown in Figure 12 itself.

About 54% of students were able to correctly identify two sub-cellular structures within their drawn cell, however, students should ensure that label lines touch the structure they are labelling. Some students incorrectly drew a thick outer line surrounding the cell, which was interpreted as a cell wall.

07.4 Three-quarters of students achieved this mark. Phonetic spellings were acceptable, however, some students' spellings were too ambiguous to achieve the mark.

07.5 The majority of students were able to correctly measure the distance between point X and Y, within the allowable tolerance. Several students were able to accurately convert cm to mm and substitute their values correctly into the equation to gain a correct answer of $\times$ 400.

Two marks were often achieved by students who had forgotten to convert their measurement to mm or who had converted incorrectly. Some students multiplied their value in cm by various factors of 10 in an (incorrect) attempt to convert to mm.

07.6 This question was generally well answered by around 62% of students, with a good proportion of these making correct reference to magnification and resolution. Several students attempted to describe each term with limited success, as references to 'bigger' or 'zoom' were not creditworthy.

Some students were able to name some subcellular structures that could be seen with an electron microscope, but failed to go on to say that these structures are smaller than those that can be viewed with a light microscope.

Question 8 (standard demand)

08.1 About 41% of students were able to correctly identify a protist as the pathogen that causes malaria.

08.2 Half the students gained the mark in this question. However, several students simply quoted values from the table without comparing them. A few students only referred to the number of people using nets, with no reference to the related incidence of malaria.

08.3 Less than half the students gained this mark, with the most common answers being that the sample size was too small or that the study was only carried out in one area.

08.4 Around 70% of students used the trend correctly to predict this answer.

08.5 This question proved difficult for many students as they simply stated methods to reduce malaria, such as vaccinations, without qualifying that these measures had been in some way improved, developed or more readily used/available in their answer. Another common answer was that more mosquitos were being killed with no further qualification.

The most common correct answers seen were 'improved health care' or 'more access to drugs to treat malaria'.

08.6 Many students were able to gain at least one mark in this extended response question with around 40% of students achieving half marks. This question differentiated between students very well.

A Level 2 response required detailed information on both a body defence and an immune defence. Some students limited themselves to Level 1 by writing only about the immune system and therefore, it is vital that students read the question carefully to ensure that they achieve maximum marks.

Most students made a correct reference to the role of stomach acid and to the skin acting as a barrier for the body defences part of their answer. Few students correctly understood where mucus is produced in the body and many confused the role of cilia, often referring to villi instead. Many students found it difficult to write succinctly about body defences and often repeated the question wording several times. A significant number of students referred to sneezing and vomiting, and ear wax or nasal hairs trapping microorganisms themselves, none of which were creditworthy.

Many responses about the immune system were detailed and students were generally able to write confidently about this aspect of the question, despite a small number of students confusing antibodies and antigens.

Question 9 (standard demand)

09.1 Around 60% of students gained both marks in this question. However, an error on the left-hand side of the equation often led to an error on the right and therefore, no marks could be awarded. The most common answers gaining only one mark (for the right-hand side) were where students wrote light in place of carbon dioxide or water on the left-hand side.

The question asked students to write a word equation and it is important for students to follow instructions carefully. If students do write a formula, they must be reminded of the conventions to use as many write CO^2 instead of CO_2, which is not creditworthy.

09.2 About 48% of students were able to correctly identify the independent variable in the investigation.

09.3 Many students struggled to identify two ways of improving the method to make the results more valid. Slightly more than a fifth of students achieved a single mark.

Many identified that repeating the investigation would help but failed to go on to talk about calculating a mean or eliminating anomalies. It was often clear which students had good practical knowledge of this RPA, as those that had were able to give detailed descriptions of how to control the temperature or carbon dioxide concentration.

A minority of students confused this practical with calculating the rate of transpiration using a potometer.

09.4 Around 59% of students were able to correctly calculate the mean in this question.

09.5 Having drawn an appropriate scale, most students plotted the points accurately. However, a large number of students plotted the data for the volume of oxygen, despite being clued in by being asked for value X in the previous question and being asked to plot it on the graph.

By far the biggest error was in deciding upon the scale for the x-axis. Many students used an uneven scale, simply using the power output values given in the table. In this question, many were unable to draw an accurate curve of best fit. The most common errors were drawing a point to point line with straight lines or drawing a feathery curve.

Some plotted points were drawn too finely and were then obscured by the curve of best fit. Other points were plotted using large, thick crosses which made it difficult for accuracy to be achieved within half a small square. Students must be reminded that they should draw graphs in pencil so that if errors are made, they can be corrected. Several students used additional paper after making an error, however, they drew their graph on lined paper and hence, no plotting marks could be awarded. Students must be reminded to request graph paper in such circumstances.

This question differentiated between the student ability range well with around 6% of students achieving at least one mark, and about 15% receiving full credit.

09.6 Most students were able to read the value from their graph correctly, however, careless errors were frequently made, such as students reading 1.8 as 2.8 or as 0.8. Students who failed to use a ruler often quoted an incorrect value.

Those who had plotted the data incorrectly in question 09.5 were able to access this mark by calculating the value directly from the data in the table. Many students who had given an uneven or difficult scale in question 09.5 then read their value for 75 W inaccurately.

09.7 Almost three quarters of all students identified the correct graph in this question.

Use of statistics

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

Mark Ranges and Award of Grades

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