# GCSE

# BIOLOGY

## 8461/2F Paper 2 Foundation Tier
## Report on the Examination

8461/2F
June 2023

Version: 1.0

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## General

Most questions were attempted by most of the students.

Particular problems which occurred quite frequently included:

- Paying insufficient attention to information provided in the stem of a question in order to guide a reasoned response and avoid misconceptions and the inclusion of irrelevant information – many students appear to simply read the part immediately before the answer line
- Repeating (rather than using) information given in the question, for which no marks are available and which wastes both time and space (there being adequate space provided for relevant material without recourse to additional answer pages)
- Careless reading of the question resulting in an inappropriate answer, for example failure to give a comparative answer to a comparative question, or not following instructions in multiple-choice items, such as to tick the correct number of boxes, or giving extra answers when only one was asked for in the question
- Careless reading of data from a graph
- A decline in the quality of writing – there were some students whose writing was simply illegible and it was clear that these students should have had extra support
- Striking an incorrect balance between depth and breadth of coverage in an extended prose answer

## Question 1

This question was about human hormones.

01.1 Almost two-thirds of students correctly selected the endocrine system as the name of the system with glands that produce hormones.

01.2 Two-thirds of students also chose the blood as the means of transport of hormones around the body.

01.3 Recognition of the hormone-producing glands in Figure 1 was less secure, with fewer than half of students able to assign all three names correctly to their positions in the body.

01.4 More than two-thirds of students recognised that gland D in Figure 1 was the source of insulin.

01.5 A large majority of students selected the liver as insulin's main target organ.

01.6 Around one-third of students were able to describe an effect of insulin in terms of lowering blood glucose or causing it to be taken in by cells or turned into glycogen.

Questions 01.7 to 01.9 related to the female reproductive hormones.

01.7 The vast majority of students selected FSH as the hormone that causes an egg to mature in the ovary.

01.8 The vast majority of students were able to select the name of at least one hormone that helped to maintain the lining of the uterus, and almost two-thirds correctly selected two: oestrogen and progesterone.

01.9 Two methods of contraception that use hormones were required here and, although over three-quarters of students knew at least one, fewer than a half could give two. The most common answers were 'the pill', 'injections' or 'patches'. A surprising number of students could offer no suggestions, and 'condoms' were a common incorrect suggestion.

**Question 2**

This question was about the use of quadrats for estimating the size of a population of buttercups on a lawn.

02.1 The selection from the word box of a 30 m tape measure for measuring the length and width of the lawn and a quadrat as the name of a 1 m $\times$ 1 m square frame was done successfully by almost three-quarters of students.

02.2 The sampling at random locations was selected as the appropriate method by a almost three-quarters of students.

02.3 The vast majority of students correctly selected the area of the lawn as the product of its length and width and the mean as a description of the total number of plants divided by the number of samples.

02.4 This question required students to describe how they could use the sampling data in Table 1 and the illustration of the lawn in Figure 2 to demonstrate that the population estimate was 300 buttercup plants. Students answered in various ways: multiplying the mean (per $m^2$) by the area, '2 $\times$ 150', or the total in 5 samples multiplied by a fifth of the area; all of which were correct. A not uncommon incorrect answer was to multiply the total in the 5 samples by the area. Just over one-quarter of students gave a correct answer.

02.5 Improving the accuracy of the estimate by counting and recording more samples was correctly selected by just under three-quarters of students.

02.6 Having been given soil pH as an example of an abiotic factor, most students were able to suggest another – 'light' and 'temperature' being the most common.

**Question 3**

This question was about a simple food chain and predator-prey relationships.

03.1 This was generally well done, with sun and light being very common correct answers as the source of energy for the grass. Some students included extra suggestions, such as water which was incorrect and thus disqualified the mark.

03.2 Completion of Table 2 to name one organism from the food chain in Figure 3 that matched each of the given descriptions (secondary consumer, producer, herbivore, etc) was done successfully by two-thirds of students. However, those who did not read the question carefully used the names of other organisms, such as 'lions' and 'cows' which could not be credited.

03.3 The two photographs in Figure 4 of the snowshoe hare, respectively in the summer and in the winter, showed its different fur colour in these different seasons. Students had to explain how this change in fur colour would increase the hare's chance of survival. Many students realised that the change of fur colour was important for camouflage and described this in a variety of ways. These students often went on to explain that this would help the hare to avoid being seen by predators. However, the most common omission was a description of why avoiding being seen was important for survival, with large numbers of students only restating the question '…so they survive', which was not creditworthy. Only 1 in 10 students scored all 3 marks in this question, although around a half included the ideas of camouflage and not being seen by predators such as the lynx.

03.4 Figure 5 showed students how the populations of snowshoe hare and lynx oscillated over the course of 35 years. Appropriate suggestions about why the hare population increased at various times included the decline in population of the lynx, the abundance of food for the hares and the fact that the hares reproduced. One-third of students were able to suggest two of these reasons.

03.5 Students were required to look at the relationship shown in Figure 5 to see that an increase in the number of hares resulted in an increase in the number of lynx – just over one-half were able to describe this.

03.6 A reason why the lynx population fell over the given years should have been evident from Figure 5 which showed the fall in hare population immediately before it – around 60 percent of students realised this.

03.7 This question was very poorly answered. Few students (around 1 in 20) gained both marks and the majority struggled to gain even one. Suitable reasons for the loss of biomass in the food chain between the grass and the snowshoe hare would be respiration of the hare or egestion or excretion.

**Question 4**

This question was about energy balances for cattle raised indoors and outdoors, and problems caused by the development of antibiotic resistance in bacteria that might cause disease in the cattle.

04.1 This was a simple sum that required selection of appropriate data from Table 3. Although many students used the data correctly, it was clear that many did not read the question or the table headings correctly, as a variety of answers such as '6002' (adding all the values) and '5900' (subtracting, rather than adding) were given instead of the required value: 6000.

04.2 Many students were able to substitute the correct values into the equation, thus gaining the first mark. However, when it came to giving a final answer, it was not uncommon for students to multiply the answer by 100 again, giving an answer of '25%', rather than 0.25%, thus showing a weak understanding of percentages. Fewer than half the students arrived at the correct answer.

04.3 Half the students were able to select both less movement indoors and it being warmer indoors as two reasons why it was more energy efficient to keep cattle indoors.

04.4 This question was generally well done with more than three-quarters of students stating that the cows were 'closer together' indoors and hence diseases would spread more rapidly. The idea of being 'in an enclosed space' was seen occasionally.

04.5 From Figure 7, it was evident to two-thirds of students that the antibiotic discs with no zone of inhibition (either D, G or H) were ones to which the bacterium was resistant.

04.6 The vast majority also understood that a change in a bacterium's DNA (rather than carbohydrate or lipid) was responsible for antibiotic resistance.

04.7 Most students also understood that a change in one bacterium could cause millions more to become resistant due to the bacteria having a high rate of reproduction.

04.8 The fact that antibiotic resistance in bacteria could become a problem to farmers was variously attributed to illness in the farmer's cattle, their productivity decreasing and them not being able to be cured of their illness by antibiotic treatment and hence the farmer's profits being decreased. Some students struggled to be able to express themselves sufficiently clearly in their answers and only one-quarter scored both of the available marks.

**Question 5**

This question was about the decay of milk and an investigation into the effects of temperature on the rate of decay.

05.1 Given that bacteria can cause decay, three-quarters of students correctly selected fungi as another type of organism that could do the same.

Questions 05.2 to 05.8 related to a laboratory investigation of pH changes in milk as it decayed at different temperatures.

05.2 Just over half the students were able to select the pH of the milk as the dependent variable in the investigation.

05.3 Approximately half the students selected putting the beaker of milk in a water bath as the method for keeping milk at 30 °C for 7 days.

05.4 Given the choice of amino acids, fatty acids or hydrochloric acid, nearly 60 percent of students correctly opted for fatty acids as the product of digestion of fats in the milk.

05.5 The graph in Figure 9 showed the pH changes in milk at 5 °C, 20 °C and 30 °C over 7 days. Most students correctly selected the option that all the fat had been digested as the reason for the pH not falling below pH 4.5

05.6 Explanations of why the rate of fat digestion was higher at 30 °C than at 5 °C were often rather weak – such as 'the enzymes work better' or 'the enzymes are at their optimum temperature' or 'chemical reactions are faster', none of which really went beyond what had been stated in the question. Only about 1 in 6 could add a proper explanation in terms of more energy being available at the higher temperature or particles colliding more frequently or the enzyme having a higher activity or the bacteria reproducing faster.

05.7 This question was a structured calculation requiring reading two pH values on the 30 °C line on the graph in Figure 9 and then subtracting one from the other. Around three-quarters of students were successful but errors included incorrect values being read from the graph and an inability to do the subtraction.

05.8 Given that the fall in pH at 5 °C was 0.1 pH units per day, students had to calculate how many times faster their answer to question 05.7 was than 0.1. Just under half were successful. Many made the error of subtracting the values instead of dividing.

**Question 6**

This question was about filtration in the kidney and the benefits of a kidney transplant compared with dialysis for the treatment of kidney disease.

06.1 The vast majority of students were able to link the boxes correctly to show that glucose molecules were small enough to pass through the kidney's filter and that protein molecules were too large, as shown in Figure 10.

06.2 This should have been a simple subtraction of the data in Table 4:

$$160.0 – 1.9 = 158.1$$

To show the volume of water reabsorbed by the kidneys in one day. However, only one-half of students did this correctly. Some added the figures, some multiplied and some divided them.

06.3 This was an extended response question to evaluate the claim that it is better to treat a person with kidney disease by using a kidney transplant rather than by dialysis. Students were instructed to make use of the 8 points of information given in Figure 11.
Students only had to assign information from Figure 11, or their own knowledge, as being in favour of or against kidney transplant. No further overall judgement was required.
The most common omission was for students to simply copy information from Figure 11, without identifying the ideas as being in favour of a transplant or against one.
Those students who gained marks commonly referred to the lower cost of transplant or that the transplant may only last for 10 years. Many others described the inconvenience of dialysis, as being in favour of a transplant.

Most students appeared unaware that patients on dialysis must also take drugs, so simply referring to the inconvenience of drug taking was insufficient; the consequences of the different types of drug were required.
A few students referred to the danger of rejection or having to wait for a suitable donor; but such ideas were usually offered only by better students, as was the idea that transplant patients tend to feel well all the time.
In order to gain marks at the highest level, answers needed to include both advantages and disadvantages of a kidney transplant.

06.4 Given some information about the cost of a transplant operation and the subsequent annual cost of drugs, students had to calculate the overall cost for the first 5 years.
Many students arrived at the correct answer of £37 000, although a few added £5 000 to the first year as well, giving £42 000. If they did the latter, 2 marks out of 3 were still available. Weaker students added the first year's cost and the subsequent annual cost, then multiplied the whole by 5, and could not be awarded any credit. Around half of the students were completely successful.

**Question 7**

This was the first of three questions common to both the Foundation and Higher Tier papers.
It was about different species of bird living in the same habitat

07.1 Just over a quarter of students selected the term community for describing all of the organisms living in the same habitat. Ecosystem was a very strong distracter and was selected by twice as many as those who chose the correct answer.

07.2 Nearly all students selected the pair of birds with a common generic name, the brambling and the chaffinch, as those being most closely related.

07.3 The fact that the two species named in the question could not breed together to give fertile offspring was recognised by just over half as the criterion for them being different species.

07.4 In this question, students had to describe one of the patterns from the graph showing how the number of birds of four species varied throughout one year. Students were expected to make reference to the months given on the horizontal axis. A suitable answer included the number being constant from January to April, then increasing during April and May and finally decreasing over the remainder of the year. Many answers were less precise and fewer than one-fifth gained all 3 marks, although a similar proportion of the students gave at least two valid points.

07.5 Half of the students were able to select species B as the one with the lowest resistance to the disease as its numbers fell the most during the given months of June and July.

07.6 In this question, students had to decide which species migrated between the UK and other countries, giving the reason for their choice. Around one-third correctly selected species D, giving its presence on the graph only between May and September (or being present only in the summer, or absent the rest of the year) as their reason.

## Question 8

This was the second of three questions common to both the Foundation and Higher Tier papers. It was about the functioning of the eye and included a description of an investigation of reaction time.

08.1 Only a quarter of students correctly selected accommodation as the term relating to adjustment of focus. Adaptation was chosen by many more.

08.2 Around one-third of students knew that the image would be focused on structure B in Figure 3 (the retina).

08.3 Just over half knew that structure E (the ciliary muscle) would contract to focus on a near object.

08.4 Students experienced some difficulty in describing what happened to the shape of the lens when focusing on a near object. Acceptable terms included becoming fatter / thicker / rounder or more convex or more curved. Terms such as 'larger' were considered ambiguous and 'more concave' (used by many) was simply incorrect. Only 1 in 7 gave acceptable answers.

08.5 Given that the iris contains muscles, students had to desribe the role of these muscles for assisting in clear vision when moving into a brightly-lit area. Some evidently did not read the question carefully and described the precise opposite – moving into a dimly-lit area. Many were confused between iris muscles and ciliary muscles. Reference to radial and circular muscles were ignored as this went beyond the detail required by the Specification.
A surprising number suggested that, in brightly-lit areas, having more light entering the eye would be necessary, to see more.

Students were required to give two details from the muscles contracting, reducing the size of the pupil and a decrease in the amount of light entering the eye. Approximately one-third scored one mark but only 1 in 10 gained two.

08.6 This was an Extended Response style of question in which students had to plan an investigation to test the effect of drinking coffee on reaction time. Most opted for the ruler drop practical but the level of detail included was highly variable. The instruction in the question was 'You should include...how to make the investigation valid' which incorporates the concepts of control variables, repetitions and the calculation of mean values. Many students omitted such details, and only 1 in 7 scored full marks.
Some insisted on measuring the time taken for the ruler to be caught using a stop-clock. And it appeared that some students had omitted this practical from their revision as ideas about timing catching a ball thrown at them were not uncommon.

## Question 9

This was the third of the three questions common to both the Foundation and Higher Tier papers. The topic was reproduction and selective breeding.

09.1 The most common advantage given for growing genetically-different tomatoes was that some might be less susceptible to disease, although others, such as producing different-sized tomatoes, were also given. Just over one-third of students gave a suitable answer.

09.2 Deciding on an advantage for growing genetically-identical tomatoes proved more problematic and only one-fifth could suggest a feature such as all growing at the same rate or all having the same named desirable feature such as high yield, disease resistance or flavour.

09.3 Very few students could successfully describe what is meant by tissue culture. Use of tissue as the starting material was deemed inadequate and required amplification in terms of cells being grown. Only around 2 percent gave an appropriate answer.

09.4 Almost half of all students were able to suggest why genetically-identical tomatoes growing in a garden might not all attain the same height – for example, due to variations in light intensity, ions, water or temperature in different areas of the garden.

09.5 This question was about sex determination in dogs. Students had to use the symbols X and Y to complete a blank Punnett square. Most knew that the male dog would produce gametes containing either an X or a Y chromosome, and that all the female gametes would contain an X chromosome, and over a quarter were successful in the completion of all aspects of the Punnett square.

09.6 The explanation of why a litter of six puppies might be expected to consist of three males and three females was straightforward for only a minority of students: either in terms of the expected 1:1 ratio of males and females or the inheritance of a Y chromosome by only half of the offspring (as demonstrated in a correct answer to the previous question).

09.7 This question was about the breeding of chickens for meat production and egg production. Given the results of an investigation in Figure 5 which showed that chicken variety A had high egg production while variety B grew more quickly, students had to suggest two control variables for the investigation. Many answers were rather vague – such as the same ‘living conditions’ / ‘environment’. More specific conditions, such as temperature, lighting, amount or type of food, all being kept indoors or all outdoors, were required. The most common correct answer related to the chickens’ food. Fewer than half of the students could suggest at least one suitable control variable, and only 1 in 8 could give two.

09.8 The data in the investigation had come from 500 chickens of each variety and students had to give a reason why such a large number had been used. Acceptable answers included the idea this would be more representative, or would give a more valid mean, or would reduce the effects of any anomalies (and not that it would ‘eliminate’ anomalies). A little over one-third of students were successful.

09.9 In this question, students had to describe how selective breeding of the two chicken varieties might produce a new variety of chicken that was good for both meat production and egg production. Many answers lacked precision: thus it was not often evident that only the best from varieties A and B would be mated and that the best (for both qualities) from the offspring would then be selected and mated, and that this would be continued over several generations. Often, it was impossible to tell from students’ answers which generation of chickens was being used: the original parents, the first generation offspring or subsequent generations of offspring. The term ‘repeat’ was often used in an ambiguous context. Thus only 1 in 500 students scored all 4 marks, and only 1 in 25 gained at least half-marks.

## Mark Ranges and Award of Grades

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