

GCSE
Biology
8461/2F

Report on the examination

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General comments

The demand of this year's questions compared favourably with those of previous years, with the mean mark increasing slightly from 2024.

It is important that students understand the requirements of the command words used in question papers to build confidence in accessing the questions. Across the paper, often a lack of scientific terminology meant that credit could not be awarded, particularly for describe/explain questions and those requiring an extended response.

There was a noticeably large number of questions not being attempted by students this year – especially for those requiring an extended answer such as 10.2 where 25% of students did not write anything. Students are encouraged to attempt all questions.

Illegible or very small handwriting continues to be an issue for many students - and centres should work with the students to support them in overcoming this. Students are reminded to use a black pen for writing to ensure answers are clear when scanned in for marking.

Mathematical skills across the paper were generally comparable with previous years, particularly when completing a Punnett square diagram and plotting a graph. We continue to see many students getting muddled and making conversion errors on calculations.

From the Required Practical Activities assessed in this paper it is clear when students have been given sufficient opportunities to not just complete them, but to interpret any data collected and consider the validity of the methods used. Students that have not been given these opportunities are at a significant disadvantage, as this is evident in their performance.

We continue to see examples of incorrect formulae in some student responses. Students are reminded that any chemical formula used should be in the correct format e.g. CO_2 . Credit will not be given for incorrect formulae such as CO^2 , 'CO2 or Co_2 .

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

45% of students knew the definition of a dominant allele.

01.2

Three quarters of students correctly identified 'hh' as the genotype of the white rabbit.

01.3

Three quarters of students successfully identified the correct male gametes and used them to derive the offspring, demonstrating a secure understanding of fundamental genetic principles. A small number of students incorrectly provided diploid or no gametes, preventing them from earning marks for the Punnett Square portion. However, it is worth noting that some of these students were still able to gain marks in subsequent questions, indicating an understanding of other aspects of the problem despite the initial error. Similarly, other students who provided incorrect gametes still managed to pick up some marks elsewhere in their answers.

A common issue observed was students overwriting their letters, making it challenging to distinguish between 'H' and 'h'. For future assessments, students should be advised to clearly cross out any incorrect letters and rewrite their intended answer close to it, to ensure legibility.

01.4

60% of students correctly drew a ring around one homozygous offspring. A little over 10% of students did not attempt this question - even those who gained full marks on **01.3**. Students are reminded to check all question parts, including those without lines or space for an answer. There were a few students who drew a ring around two offspring, and of those that did some drew a ring around both homozygotes, so still gained the mark. A minority were unable to score because they drew a ring around a gamete.

01.5

Only 50% of students were able to identify how many of the offspring would be Himalayan rabbits from their genetic cross. Some students gave '3' as their answer even when this did not match their Punnett Square suggesting they were giving a learnt response rather than one matching their previous answers.

01.6

A pleasing two thirds of students knew that male rabbits have one X chromosome in each body cell.

01.7

Almost three quarters of students correctly predicted the number of female offspring expected - although a range of numbers was seen – including some that were higher than 4. The most common incorrect answers were 1 and 3.

Question 2 (Low demand)

02.1

25% of students gained both available marks for this question. Many students who did so by using phrases like 'fast reaction' or 'quick response'. However, there were numerous instances where the question was misunderstood. A common error was giving examples of reflex actions such as flinching, blinking, or sneezing, with some students even detailing the entire reflex arc pathway.

02.2

Around 70% of students gained at least one of the two available marks for this question, most commonly for knowing that the arm muscle was the effector. Some chose the correct words but put them in reverse order.

02.3

Only a fifth of students were able to correctly connect all 3 boxes. Just over a third of students were able to score 1 mark, mostly by correctly identifying P as a sensory neurone. A significant number incorrectly identified R as a reflex neurone.

02.4

Two thirds of students knew that information travels across a synapse as a chemical.

02.5

Over 80% of students correctly calculated the mean value as 16 and gained both marks with a pleasing number of those showing their working. A few students gave 39.3 as their answer (presumably because they forgot to add the values before dividing by 3 and entered $18 + 17 + 13 \div 3$ into their calculator – resulting in only the 13 being divided by 3). Others simply chose the middle value of 17. A common incorrect answer was 48, for adding the values correctly but not dividing by 3.

02.6

Almost two thirds of students gave correct evidence for the student's conclusion. A minority of students misread the question and answered *why* practice improves the speed, however, those that gained the mark generally did so for simply stating 'the reading on the ruler went down'. Unfortunately, some students went on to contradict themselves by saying that the reaction time increased.

02.7

Half the students gave a correct improvement to the investigation and gained credit here. Most answers expressed the idea of repeating the experiment (either more times or with other students). Using the same starting position and resting the student's arm on the bench was also commonly seen. A few mentioned the use of an online test or computer program to test reaction times which was pleasing to see considered.

Many students incorrectly thought that an improvement would be to change the experiment by introducing a new variable – such as using the other hand or having a caffeinated drink. A notable number suggested using a stopwatch instead of the ruler, which again was not creditworthy, as this would introduce additional reaction times to the measurement.

Question 3 (Low and Standard demand)

03.1

Three quarters of students knew that sperm are produced in the testes/testicles. There were many alternative phonetic spellings of testes and testicles seen which were given credit. The most common incorrect answers were ovaries and penis along with other parts of the male and female reproductive organs. 'Genitalia' and colloquial terms were also frequently seen uncreditworthy answers, along with a few unexpected parts such as pancreas, stomach and spine.

03.2

All combinations of numbers were seen, including that for the compensation mark. Just under 40% of students gained both marks.

03.3

95% of students knew that fertilisation was the process where a sperm cell joins with an egg cell.

03.4

Over 50% of students knew that pollen is the male gamete in a flower.

03.5

60% of students knew that mitosis produces new cells in runners.

03.6

Over half of students could identify at least one substance that passes through the runners, with a further 25% being able to identify both sugar and water.

03.7

A third of students were able to give one advantage of reproducing sexually.

The most commonly awarded mark was for the idea of variation, either given in those terms or that the offspring would not be the same. All other bullet points were seen, with the idea of dispersal being the next most common. The most frequent reason for not gaining the mark here was for giving an advantage of asexual reproduction, possibly through having misread the question.

03.8

Over 50% of students were able to give one advantage of reproducing asexually with bullet points 1, 3 and 4 most commonly seen. Several students gave more than one idea in a single sentence e.g. 'it is faster because there is no need to find a mate'. A few students implied the idea of the offspring gaining resources from the parent plant but did not specify water or a named nutrient, instead referring to 'nutrients', so were unable to gain credit for bullet point 6. Others referred to asexual reproduction as being 'easier' without elaborating as to how this manifested itself. As with question **03.7** some students were unable to gain this mark because they gave an advantage of the other type of reproduction.

Question 4 (Low and Standard demand)

04.1

Students were given data showing how much water a person gained and lost by different methods and were asked to complete a bar chart. Generally, this question was answered very well, with 75% of students gaining both marks. Around 5% of students did not attempt the question. There was some mis-plotting seen, usually due to misreading the scale. A common error was not labelling the bars, so mark point 2 could not be awarded.

04.2

Over 70% of students knew that the volume of water lost by sweating on the day of a race would be greater.

04.3

In this question, the students were told to draw one line from each box on the left to the appropriate box on the right. Some students drew two lines from a box on the left and thus did not gain the mark for that process. A pleasing 66% of students gained full marks. A common error was to have 'Excretion' linked to 'Removes water from the blood' or 'Filtration' linked to 'Takes excess water out of the body'. Only just over 5% of students did not understand the processes in the kidney and scored no marks at all.

04.4

This was a levelled response question, in which students were given some facts about kidney transplants and dialysis, and asked to evaluate the two methods of treating kidney failure. They were also told to draw on their own knowledge in their answer. 10% of students did not attempt this question.

A significant proportion of students simply copied the information given in the question without any modification or comment and were among the 20% of students that scored no marks. There had to be some original content in the answer for it to be worthy of credit. It was apparent that several students had little awareness of the processes involved with either type of treatment giving comments such as 'Transplants only take a couple of hours – you just need a donor'.

A pleasing number of students identified the improvement to lifestyle due to not needed to go for regular/long hospital visits, and similar numbers of students considered the issue of rejection. Over 40% of students that gave both an idea in favour and against kidney transplant were given credit in Level 2.

Many students gave a partial reason in their arguments which did not gain credit such as 'It is less expensive', 'You have to take drugs', 'It's risky'. The source of the donor organ was seldom referred to, and when it was, was generally assumed to be a living relative or a kind stranger. A large number thought that the cost of treatment was the responsibility of the patient and that might affect their choice of treatment. Giving a one-sided argument – that is - giving only points for or points against transplant, limited the student to one mark in Level 1.

Question 5 (Low and Standard demand)

05.1

Almost 75% of students knew that A, C, G and T are called bases.

05.2

Only 40% of students correctly calculated that 3 amino acids were coded for by the section of DNA given. The most common wrong answers were 2, 4 and 9. Some students who gave 2 as their answer had highlighted the two copies of AGTA within the sequence.

05.3

Almost three quarters of students knew that a change in DNA is called a mutation.

05.4

Students were given a graph showing cases of MRSA in one country and asked to calculate the mean rate of increase for a period of 12 years. There was a lot of confusion about how to do this calculation and only 10% of students achieved full marks.

The most common incorrect answer was seen when students chose to add up the cases per million for each year from 1993 to 2003 and divide by either 12 (years) or 7 (number of readings). Although their list of readings from the graph would have included 1 and 40, MP 1 could only be awarded if the student went on to indicate that these were the relevant readings for this question.

There was a number of incorrect readings from the graph that could not gain credit for mark point 1 – but did not preclude the student from gaining subsequent mark points. Other common errors were forgetting to subtract the 1 or reading the graph as 1 million and 40 million rather than 1 and 40. Many students gained mark point 1 for the correct readings from the graph but then proceeded to do the wrong calculation. Some students gained mark point 1 for getting 39 by adding together the increase between each straight section of the graph; '5 + 5 + 2 + 6 + 6 + 15' rather than doing 40 – 1.

10% of students chose not to attempt this calculation.

05.5

Nearly 60% of students knew that the word resistant describes bacteria that are not killed by antibiotics.

05.6

Students were asked to suggest a reason for the decrease in MRSA cases after 2006. A pleasing 60% of students were able to do so with all bullet points seen across the range of responses. By far the most common correct answer was to do with vaccination. Many students also implied the discovery of a new antibiotic/drug by referring to one that works to kill the bacteria (as opposed to the current ones that do not). Some students missed out on the mark by just referring to 'a cure being found' – which was too vague.

Question 6 (Low demand)

06.1

Almost 60% of students knew that pondweed gets its energy from sunlight.

06.2

The question asks for the student to interpret the food web given on the paper. Only half of students were able to identify a primary consumer from the food web. There was a range of answers showing that some students were not sure of the terminology of a food chain and where a primary consumer would correctly be found. A few students did not refer to the given food web and made up their own primary consumer – some examples being an eagle, a tiger, or a shark.

06.3

Over three quarters of students identified the correct pyramid of biomass for the food web.

06.4

Around half of students knew that 1% of the biomass in the algae is transferred to the fish.

06.5

Only 20% of students gained no marks in this question – with 40% of them knowing that energy is lost from organisms via faeces and movement. A further 40% scored one mark for identify one method.

06.6

Students were presented with a tally chart and asked to convert the tallies into numbers for each organism. If all 3 totals were correct, then the student was awarded 2 marks – which was the case for 85% of students. If one or two were correct they were awarded only 1 mark. The few students that did not understand tally charts either copied the lines or did not attempt the question.

Question 7 (Low and Standard demand)

07.1

Many students were able to calculate the percentage of carbon dioxide in the biogas. Some wrote the necessary sum correctly and then possibly entered it into their calculator incorrectly to arrive at the wrong answer and thus gained just the one mark. Others knew it was necessary to subtract 63 from 100 but sadly arrived at an answer of 27 or 47.

The most common ways of not being able to score a mark were to involve 360 in the calculation or to subtract 3 from 60. In total, just over a third of students gained both marks.

07.2

Students were given a graph on the production of biomass from chicken and cow manure and asked to give evidence for 3 scientific conclusions. Over a third of students gained 2 of the available 3 marks, with mark points 1 and 3 being commonly seen. Many gained mark point 1 by giving the values for production of the two types of manure. Some could not be awarded mark point 1 for stating that more chicken *manure* was produced rather than more biogas.

For mark point 3, reference to the line going straight after 4 weeks was not equivalent to the idea of the line levelling off and so did not gain credit.

Answers to mark point 2 were often ineffectively expressed and so students were unable to score this mark. Many students referred to the rate being fastest in the first week and then slowing down which was not creditworthy as just being a repeat of the question stem.

Students who tried to use data to support the conclusion often just gave the numbers for the production from the two types of manure after the first week which was insufficient for credit, without further qualification.

07.3

All combinations of words were seen, with some students seemed to think that they had to use all three options despite the instructions to the contrary. A pleasing 80% of students gained the full 3 marks.

07.4

Only 20% of students gained this mark.

All marking points were seen with the issues of cost being those most commonly credited.

Many students missed out on the mark by referring to the distance from the sea without any mention of the implication of that on transport, time or cost. Several students gave the idea of the production of more biogases being a bad thing for the environment – which was not creditworthy.

07.5

Just under 10% of students gained both marks for fully explaining why the farmer spreads the manure on fields where crops will be grown. However, 70% of students did gain 1 mark – most commonly for the idea of helping the crops to grow. Many students gave an answer that included both mark point 1 and the compensation mark – which could consequently only be awarded 1 mark. The majority of students missed out on mark point 2 by referring to nutrients rather than to the more specific minerals/ions. The 'allows' in the extra information were rarely seen.

Question 8 (Standard demand)

08.1

This question required students to apply their knowledge of fossil formation to the specific example of an ichthyosaur fossil.

Only two steps in the fossilisation process were required to score full marks, so misunderstanding or omission of one step, was not critical. Only 7% of students achieved the full 2 marks, with 60% scoring no marks or not attempting the question.

Students that gained credit often did so for showing an understanding of the first step in fossil formation, by referring to sediment, or an appropriate synonym. However, several also referred to the dead animal being buried in 'rock' or in 'rocks' which disqualified this idea. Whether this burying occurred before or after decay was not important in the award of the mark.

Although some students were aware that the dead ichthyosaur had decayed, they were often imprecise in terms of what had decayed. Some described the whole 'body' or the 'tissues' decaying, which implied that both soft and hard material decays. Very few students referred to the soft tissues being eaten (by detritivores).

08.2

Students were provided with the length of the fossil image and the relevant magnification factor and were required to calculate the real length of the fossil.

Many students completed this calculation well with 40% gaining all 3 available marks. The most common error was in converting millimetres to metres, where a conversion factor of 100 was not uncommon. Some students completed the conversion in two steps, first converting to centimetres, then to millimetres, perhaps showing a lack of confidence. A not uncommon error was for students to use the magnification equation, with the two values as numerator and denominator. It was rare then, for students to attempt to convert their answer to metres.

08.3

Students were required to recall the classification hierarchy, completing a partial classification using given terms.

This was very well attempted with over half of students gaining at least 1 mark. It was clear that many students had remembered the sequence by using a mnemonic. However, many students confused population for phylum, presumably due to the same initial letter.

08.4

Students were required to suggest causes for the extinction of ichthyosaurs, and over 50% of students gained at least one of the available 2 marks.

Although this should not be an unfamiliar question to students who have practised from previous examination papers, the context of the information provided meant that some general answers were insufficient. The information in the question was that ichthyosaurs lived in the sea, consequently 'drought' was not credited. Similarly, the information provided stated that ichthyosaurs were in competition with other predators for food, thus a 'lack of food' was ignored, as was the presence of 'predators'. For this last idea, a mark could only be awarded if any predators were described as being 'new'.

Common correct responses included reference to 'disease' and 'habitat loss', although all of the possible answers were seen.

Question 9 (Standard demand)

09.1

Students were given a method for an investigation into numbers of daisy plants growing in a field at different distances from the tree. A quarter of students knew that the steps were repeated to remove all the water, or to ensure all the water had evaporated. Common incorrect answers seen included 'to improve accuracy', 'to identify anomalies' and 'to remove excess water'.

09.2

Students were given data from an investigation into the number of daisy plants growing at different distances from a tree. They were asked to calculate a percentage and give their answer to the nearest whole number. This calculation was attempted by around 80% of students, with 20% being awarded the full 3 marks. Of those students that did not gain all 3 marks, those that showed their working out were able to gain one or two marks. Students should be encouraged to always show their working out for calculations.

09.3

A pleasing number of students was able to describe the effect of distance from the tree on the percentage of water in the soil – with almost 45% gaining credit. Students who simply stated 'it increased' did not gain credit as both reference to the distance and the percentage of water were required for the mark.

09.4

Students were asked to consider changes to the investigation that would increase the validity of the conclusion. Bullet point 1 was most commonly seen, although students stating simply to 'repeat it' without qualification could not be given credit at this level of demand. Around a third of students gained at least one mark for this question.

09.5

Around a third of students were able to suggest at least two abiotic factors that might have caused more daisy plants to grow further from the tree, with a further 7% of students gaining all three marks. The full range of possible correct responses outlined on the mark scheme were seen, with light being the most common. A few students negated a correct abiotic factor by suggesting the tree (biotic) was the cause – for example 'shade from the tree'. Vague answers such as 'soil' or 'weather' did not gain credit, and despite being told in the question not to refer to water, a small number of students referred to rainfall, humidity or drought which again could not be credited.

Question 10 (Standard demand)

10.1

Only a quarter of students gained a mark in this question, with less than 10% of students able to fully define geotropism and gain both available marks. Of those students who did not achieve both marks most of them were clear that a tropism affected the growth of the plant but were unclear of the link between geotropism and gravity, with references to geographical features being a common incorrect response. 30% of students did not attempt this question.

10.2

Around 25% of students did not attempt a response to this question.

This extended response question required students to plan an investigation, with some examples of equipment suggested. It was clear that many students had carried out the required practical on tropisms which was assessed in this question. Around 10% of students reached Level 3, with the majority of those gaining full marks. Those that did successfully described investigating at least 2 light regimes as well as measuring/observing results and giving several control variables.

Some students that did not gain full marks did so for predicting the results, rather than describing how to take final measurements and/or observations in the investigation. Many students scored some marks due to being able to list relevant control variables. Some students thought placing seedlings on a windowsill would give them all-round light and therefore provide a comparison with the seedlings placed in the box with a slit. In this case, both sets of seedlings experienced unilateral light. Around a quarter of students were limited to level 1 mostly due to being unable to provide a comparison between the effects of unilateral light and all-round/no light.

10.3

This question was not attempted by around 30% of students, however, 25% of students were able to name the hormone auxin. Where incorrect responses were seen, it was usually for naming a human hormone such as insulin or progesterone.

10.4

A third of students knew that an uneven distribution of the hormone controlled the plant's responses to the direction of light.

10.5

15% of students did not attempt this question.

The question required students to explain how a plant's response to light aided survival. Many students used up much of the available space explaining how a plant responds to light, describing how unilateral light influences the uneven distribution of auxin, resulting in uneven growth of the stem. Despite sometimes showing good detail, this was not required, as the question asked how this response was advantageous to the plant. These students then often omitted more than passing reference to the focus of the question, perhaps stopping at the idea that this allowed the plant to 'receive light'. Many students seemed unaware that even if the leaves are directed away from the light source, they will still be able to absorb light. What was required in responses was that by facing the light source, leaves could absorb *more* light, allowing *more* photosynthesis resulting in *more* glucose being produced. Those students who did not incorporate the idea of 'more' into their answers could gain one mark for linking two of the critical processes of light absorption, photosynthesis and glucose production.

Only 25% of students gained any marks in this question, usually for making a connection between plants absorbing light allowing photosynthesis to happen – thus gaining the compensation mark - as they neglected to mention these factors were increased or maximised. Mark point 3 was least commonly seen.

Mark Ranges and Award of Grades

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