Questions matter

GCSE

Biology

8461/2H Paper 2 Higher Tier

Report on the Examination

8461
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General comments

The standard of responses seen across the range of questions demonstrated an improvement in performance generally compared to last summer. It was evident in responses when students had a good understanding of Required Practical Activities, and when they had not. Maths skills across the paper were of a good standard, although completing a pyramid of biomass proved to be inaccessible to a number of students.

It was common to see marks unnecessarily missed, due to paying insufficient attention to the information provided in the stem of a question which is designed to guide students to give a relevant response.

Some weak 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 ink or their work may simply be indecipherable. Those with weak handwriting would have benefitted from additional support. Students completing work on word processors are reminded not to waste time copying out the questions as they will run out of time to complete all questions.

Levels of demand

Questions are set at three levels of demand for this paper:

- **Standard demand** questions are designed to broadly target grades 4–5.
- **Standard/high demand** questions are designed to broadly target grades 6–7.
- **High demand** questions are designed to broadly target grades 8–9.

A student's final grade, however, is based on their attainment across the qualification as a whole, not just on questions that may have been targeted at the level at which they are working.

Questions 1, 2 and 3 are common with questions 9, 10 and 11 on the Foundation Tier. These questions are identical with each other and are targeted at standard demand.

Question 1 (standard demand)

01.1 Over 70% of students were able to define a mutation correctly. Those that did not gain credit generally knew that it was something to do with 'a change', but this was anything from a cell or a particular characteristic of a phenotype to a whole species changing.

01.2 A third of students were able to give a full description of natural selection to gain full marks. 15% of students did not gain any marks at all for this question. Very few students talked about variation for the first bullet point. Bullet points 2 and 3 were the most common marks gained by students - the third bullet point often awarded for the implication that those that survived went on to breed, and often was by mentioning 'offspring' in marking point 4. Vague references to 'traits' or 'characteristics' being passed on were not creditworthy in bullet point four. Students who were able to give an example of natural selection had better structures to their answers, with giraffe necks being the most common example given.

01.3 Just over 75% of students were able to identify Alfred Wallace and Alexander Fleming as the scientists that suggested the theory of evolution by natural selection.

01.4 Over 85% of students managed to gain at least one mark in this question, most commonly for stating 'the hoverfly looks like the wasp'. Marking point 2 was rarely awarded as students did not explicitly refer to the wasp. Some incorrect answers referred to the hoverfly being able to camouflage which did not gain credit. Overall, the main reason marks were not awarded was because of vagueness, or poor articulation of ideas.

Question 2 (standard demand)

02.1 Some students appeared to be confused as to how decay happens, believing that the dead plant matter would decay itself. However, the majority of students did indicate that some sort of microorganism is involved in the decay process, gaining the third mark in the mark scheme. 40% of students gained at least 2 or more marks overall.

Some students spent time unnecessarily describing the factors needed for decay and often needed to extend their answers onto the additional pages.

There were two routes students could use to gain marks. Many students' answers included elements of both routes, so examiners awarded a mark for the described route which gave the higher mark. In most cases this was the first route given in the mark scheme.

The information in the question told students that layer B contains 'very little oxygen' and 'has a low pH'; thus, simply repeating either of these was insufficient to gain credit. To gain the first mark, students needed to link one of these pieces of information to their own knowledge, either in terms of respiration or in terms of enzymes being denatured or reducing in activity. Many students also gained this first marking point, although some who took the second route demonstrated confusion about what a 'low pH' constitutes, describing it as 'low acidity' or 'being 'alkaline'.

Achieving marking point 2 proved to be more problematic for many students, most simply by omitting any reference to energy or metabolism. Students should be advised that when referring to respiration in their answers (as many did), they should then go on to describe the role of respiration: 'releasing energy'. For those who did refer to energy, it was noted that very few described energy being 'produced', which is never acceptable as this would contradict the principle of conservation of energy.

02.2 Just under 70% of students identified the correct answer regarding the approximate biomass of moss that becomes biomass in primary consumers.

02.3 Half of students identified DNA as a substance that can be made using phosphates.

02.4 Around 65% of students could identify protein as the substance that can be made using nitrogen.

02.5 This was a well answered question, with almost all students gaining at least one mark, and 65% of those gaining three or more marks. A number of students described a rise in temperature of the Earth's atmosphere, gaining marking point 1.

It should be noted that the 'greenhouse effect' and 'climate change' are not equivalent to 'global warming'. A significant number of students attempted to describe the mechanism of global warming. This was often confused, including references to the 'ozone layer' and incorrect descriptions of long and short-wave radiation. However, such descriptions are beyond the requirements of the specification, so were ignored.

Students who merely repeated the information that the peat bog 'contains' carbon dioxide and methane could not be awarded marking points 2 or 4. Instead further added value was required, in that these gases would be 'released' from the peat when the bog was destroyed. A significant number of students omitted any reference to methane, so were unable to gain marking point 4.

Again, students should be advised that repeating the information in the question will not gain credit, such as those that described 'the use of peat as a fuel' releasing carbon dioxide. To gain credit here, students needed to indicate that the peat would have to be 'burned' to produce carbon dioxide. In this case, examiners ignored the idea that burning would also release (trapped) methane, as this would inevitably also be burned, releasing more carbon dioxide.

Question 3 (standard demand)

03.1 Just under 70% of students successfully identified an improvement to the method. The most common creditworthy responses were 'repeats', 'collect more water' or a description of avoiding double counting of the tadpoles. As the experimental time frame given was 8 weeks, improvements that suggested extending this time period were not given credit.

03.2 Over 95% of students correctly carried out the simple calculation. Students using the row rather than the column was the main reason to not score marks.

03.3 Students were asked to complete a graph to show how the total number of tadpoles changed over the 8-week period. Over 90% of students scored 3 or more marks, with a mark commonly missed for not labelling the *x*-axis or failing to use a linear scale.

Plotting the points was mostly done well and students that did lose the marks was due to accuracy as each small square vertically was 2 units. The line of best fit should have been a smooth curve through the points, but some students used a ruler to draw a straight line of best fit or simply joined the plots dot-to-dot – neither of which gained credit.

03.4 Students are asked to calculate the percentage of the tadpoles that would still be found in the pond at four weeks compared to zero weeks, using the data from their graph. Around 75% of students gained the full three marks for this calculation. Many students achieved marking point 1 only for using the values from their graph at 0 and 4 weeks. They then could not use the values correctly to determine the answer.

A common incorrect approach was to take the answer for 4 weeks away from 60 before multiplying by 100. A noticeable number of students chose not to use their graph but instead used data from the table, allowing some credit to be given as long as the values from the table were correct.

03.5 Over 65% of students gained full marks in this question for correctly suggesting two reasons why the tadpoles died. The most common correct answers were 'not enough food', and then reference to predators or disease. The most common uncreditworthy responses seen were vague references to changes in environment/conditions, lack of parental care and natural selection. Effects of the experimental method were ignored.

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

04.1 Just over half of students knew why the student placed both sets of apparatus in the dark. Many answers referred to preventing phototropism to gain the marking point. Some students referenced control variables, which was insufficient to gain the mark. Many incorrect responses did include references to gravity, however the response was not qualified with 'only gravity' as per the mark scheme, so therefore could not be awarded the marking point. Vague responses such as 'to keep it a fair test' or 'to make sure nothing affects the investigation' also could not be credited. Other students did not refer to results/growth, for example, 'so light doesn't affect them'.

04.2 A third of students identified two reasons for surrounding the seedings with damp blotting paper, gaining full marks. A noticeable number of students only ticked one box and students are reminded to read the question carefully.

04.3 Around 45% of students gained one mark on this question, with a further 10% gaining both available marks. Marking point 1 was by far the most commonly awarded mark, with many students realising that Apparatus B was for a comparison. Marking point 2 was awarded much less often as many students lacked detail in their responses and could not be given credit. For example, many responses referenced that Apparatus B 'removes' or 'cancels' gravity rather than the *effect* of gravity. However, the correct representation of this alternative point was by far the most common seen for marking point 2. Some students only described the distribution of auxin which didn't answer the question, so were not credited.

04.4 In this question students were asked to complete a diagram of the root after 24 hours to show both the appearance and the ink marks expected. Almost one third of students gained full marks for their diagram. Students that drew the root completely straight were restricted to 1 mark, assuming they had drawn the root longer. The spacing of the ink marks in marking point 3 proved challenging for many students, often drawing them all equal, or adding in spaces before the bend which negated this mark.

04.5 55% of students knew that the root would grow straight and gained the mark. However, a minority of students suggested that the root would grow 'straight*er*', which implies some bending and therefore, could not be credited.

04.6 Students were asked to explain how auxin causes the results in Apparatus A. Over 50% of students did not score anything on this question, with 20% gaining both available marks. Many students conveyed the idea of uneven distribution of auxin, but several students became confused as to which side of the root had the most growth. Other responses lacked comparative language when explaining the direction of growth and could not gain credit for marking point 2. Some responses referenced light affecting the auxin and just wrote about what they knew about auxin rather than addressing the question.

04.7 Just over 30% of students gained at least one mark for giving a use of auxin, with a further quarter of students gaining two marks. The use of auxin as weed killer, or a rooting powder were by far the most common correct answers given by students. Some responses just stated that auxins were used for growth, which was too vague at this level of demand. Many responses showed confusion between the roles of auxin and gibberellin (which was the focus of question 04.8).

04.8 15% of students gained full marks for knowing two reasons why the farmer sprayed the apple tree with gibberellin, with 45% of students being awarded at least one mark usually for the idea of 'more' or 'bigger' fruit. Many responses were awarded the fallback mark for referring to an increase in yield. Of the three alternative answers to this question, the promotion of flowering (bullet point 1) was the least common correct response.

A lot of responses referred to 'ending seed dormancy' which does not answer the question and therefore could not be credited. As with question 04.7, there was evident confusion between the roles of gibberellin and auxin.

Question 5 (standard, standard/high and high demand)

05.1 Almost 30% of students were able to suggest two ways to improve the student's method for measuring human reaction time, with a further 45% gaining one mark. Some students suggested extensions to the method rather than improvements, such as testing with caffeine or using a computer programme - which did not answer the question. A number of students gave vague responses such as 'repeat it' or 'put the ruler closer to the hand' which were insufficient for credit at this level.

05.2 Students were asked to give two ways that coordination by the endocrine system is different from coordination by the nervous system. The full range of available marking points were seen for this question, with over half of students gaining full marks. Most comparisons involved 'slower', 'longer lasting' or reference to 'electrical impulses' in the nervous system. The better answers included multiple comparisons in the same sentence ie 'endocrine is slower but longer lasting' and 'nervous involves electrical impulses carried along neurones whereas endocrine is chemicals carried in the blood.'

05.3 Over 80% of students correctly identified thyroxine as the hormone produced by gland A. Common errors included naming the gland (thyroid) rather than the hormone, or naming hormones released from the pituitary gland such as FSH, LH or ADH.

05.4 Around 80% of students were able to name one hormone produced by gland B, with insulin being the most popular response. Common incorrect responses named hormones involved in the menstrual cycle. There were mostly good spellings for 'glucagon' which has not been the case in previous years.

05.5 Almost 55% of students could describe two effects of adrenaline on the human body, the most common of which were increased heart rate and increased breathing rate. Some answers lacked detail such as 'increased awareness' or 'they have more energy' which are insufficient for credit at this level. A significant number of students gave the fall-back mark relating to preparing the body for the flight or fight response, which was only credited if no other correct responses had been given.

05.6 This was an extended response question with three levels, the highest of which was set at high demand. Students were asked to explain the use of hormones in both contraception and the treatment of infertility. Less than 10% of students were able to access Level 3, commonly due poor articulation or use of vague scientific terminology. Those that did however, showed very clear links between the correct hormones, their roles in contraception/infertility treatment and the associated consequences of using them.

Around 45% of students obtained marks in Level 2, after correctly explaining the use of at least one hormone for both contraception and infertility. Students that did not include an explanation for both contraception and the treatment of infertility were restricted to Level 1. Students are reminded to read the question carefully and ensure all parts are answered to the same standard. It was noticeable that many students spent more time explaining the roles of hormones in contraception, and then went on to possibly rush their explanation for infertility.

Regarding contraception, many students could refer to progesterone and/or oestrogen, and the subsequent inhibition of FSH and LH, but then did not specifically indicate which hormone undertook which function, and so failed to link to a consequence for either hormone. The general consequence of 'no eggs to fertilise' was regularly seen in place of these.

Regarding infertility, the same pattern was seen, so very few consequential links were credited. However, many students described the process of IVF and insertion of the embryo into the uterus, to gain credit for a general consequence.

The use of progesterone to maintain the uterus lining was often muddled with contraception, and the idea of increased *chance* of implantation, or increased *chance* of fertilising an egg for the use of LH was rarely seen.

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

06.1 Almost 45% of students were able to give a creditworthy answer having clearly learned a suitable definition, although the term 'expressed' was used less frequently by students than other synonyms. Numerous students remain confused between a gene and an allele. References to 'stronger/overpowering' alleles or suggesting they were 'always inherited passed on' did not gain credit.

06.2 Students were asked to explain how the inheritance chart provided shows that person 1 is heterozygous. Many students found it difficult to articulate their responses, with only 30% of students gaining 1 or both marks. Many students did not answer the question directly, but instead explained why the parent could not be a genotype other than heterozygous, rather than showing that they are heterozygous and did have polydactyly. Some students showed a clear understanding of the inheritance of the condition, while many students only gave incomplete answers that involved only part of each marking point.

06.3 55% of students gained all four marks by drawing and fully annotating a Punnett square to explain how the doctor determined a probability of 0.5. The 25% of students that scored three marks commonly did so for either not fully annotating their Punnett square identifying the genotypes of person 6 and 7 explicitly, or they did not identify which offspring were polydactyly. A minority of students did not gain marks by choosing to not use the letters 'D' and 'd' for their alleles, but instead chose a different letter without providing a key.

06.4 Many students correctly identified CF as a recessive condition or allele for marking point 1, and many went on to get marking point 2 also by stating that two copies of the allele are needed. Students that used the biological term 'homozygous recessive' in their explanation were awarded both marking points.

Very few students were awarded marking point 3 without marking point 4. There was clear confusion again here between the terms 'allele' and 'gene', despite the information in the question stem. A number of students gained marking points 3 and 4 with no reference to marking point 1 or 2. 15% of students scored the full four marks available in this question.

Question 7 (standard/high and high demand)

07.1 Students were provided with data regarding chickens and farmland, and were asked to calculate the area of land needed to provide enough energy from maize seeds for 1000 chickens to grow to full size. The mark scheme is designed to benefit the logical mathematical use of the numbers that were provided in the stem of the question.

Almost 35% of students were able to attain the maximum five marks by calculating the correct answer of 2190 m^2. Students with a final answer showing an error to the power of 10 (such as 2.19, 21.9, 21900 etc.) gained four marks in line with the marking procedure for calculations (section 3.3 of the mark scheme).

A small number of students did not convert their answer to 3 significant figures so could only be awarded four marks. Despite the high level of challenge provided by this calculation, 40% of students were able to gain 1 or 2 marks.

Students are encouraged to show their working out for all calculations.

07.2 Students were asked to complete a pyramid of biomass for maize seeds and chickens, and it was clear that many students had a weak understanding of this. 20% of students gained all three marks, with 40% of students not gaining any mark at all or not attempting the question.

Students used a vast range of different scales, but only those that were symmetrical and used over half the available grid were able to gain marking point 1. A number of students did not notice that they needed to calculate the value for chickens and not simply plot 2.2 kg. This went on to provide problems devising a suitable scale.

07.3 Over 50% of students correctly calculated the ratio of chicken biomass to maize seed biomass. Common errors were using the mean mass of 1 chicken, and not calculating the value for 1000 chickens, inverting the correct values and giving an answer of 21:11 or 1.9:1. Students are reminded to check their ratio reflects the order given in the question.

07.4 Just under a quarter of students correctly articulated what happened to the remaining 20% of the biomass in the maize seeds. It was clear a far greater number of students knew the correct answer but gave vague responses such as ‘waste’ or used colloquial terms which were insufficient for credit at this level.

07.5 85% of students correctly identified lysine and tryptophan as the amino acids found in significantly higher proportions in the QPM seeds.

07.6 Only 15% of students were able to correctly suggest why a diet containing less leucine does not slow down the growth of chickens. Many students did not appear to read all the information provided and incorrectly suggested that leucine was not an essential amino acid, or not essential to growth.

Question 8 (standard/high and high demand)

08.1 Almost 60% of students could give an appropriate definition for homeostasis and so gained the first marking point. However, many did not expand the definition to include providing optimum conditions for cellular/enzyme activity and so marking point 2 could not be awarded. Fewer than 10% of students scored full marks in this question.

08.2 Students were asked to describe what happens to glucose, protein and urea in the kidneys. There was confusion seen between the role of the liver and the kidney with a noticeable number of students stating that protein was deaminated or that glucose was stored as glycogen by the kidney. Many students struggled to articulate the filtering process and lacked clarity communicating absorption/reabsorption and what this meant in terms of where the substances ended up.

For marking point 1 many students rightly identified glucose and urea as being filtered from the blood by the kidneys. However, many also stated that protein was also filtered, which then made marking point 2 not accessible. Although a large number of students knew that glucose was reabsorbed, they did not make clear it was *all* the glucose being reabsorbed. Marking point 4 was the most common mark seen, with many using the second alternative 'urea passing out in the urine' to gain credit.

5% of students gained full marks, with the majority of students gaining 1 or 2 marks.

08.3 Students were asked to explain how ADH affects the production and concentration of urine by the kidneys. Over one third of students were not able to gain any marks on this question, with 5% of students not attempting it at all.

There appears to be a lot of confusion amongst students regarding the trigger for the production of ADH, with many students thinking ADH stops being released when blood is more concentrated. Students that did get marking point 1 correct however, often got muddled regarding the effect ADH had on the kidney tubules, and the consequences on urine production - often getting the ideas completely the wrong way around.

1 in 5 students gained a mark in this question which was most commonly for marking points 1 or 4. Marking point 2 was rarely seen, with many students simply referring to 'the kidney' rather than the tubules themselves.

Those that were clear that high ADH decreases the volume of urine, often did not communicate it clearly for credit in marking point 4 at this high level of demand. There was also some difficulty understanding the term 'concentration' with many students getting muddled between water concentration and urea concentration.

Question 9 (standard/high and high demand)

09.1 This was an extended response question and was set mainly at high demand, thus, considerable detail and the linking of ideas was required to gain access to higher marks. Two thirds of students did not gain any marks.

Many students were confused as to what 'herbicides' do (specification ref 4.6.2.4), often believing that they contain 'fertiliser', plant 'hormones', 'kill insects', 'kill bacteria' or, very commonly, 'kill herbivores'. These students almost inevitably struggled to gain any marks as their descriptions failed to refer to why GM plants produce higher yields, only that they were not damaged or could 'use the fertiliser to grow more'.

Those students who did know that herbicides kill plants were usually able to state that weeds would be killed, but the GM soya plants would not be. However, some seemed to believe that farmers might plant a mixture of non-GM soya and GM soya, just so that some could be killed by glyphosate.

Many students who got this far, were then able to describe the reduced competition for some named resource. However, getting further than this was not at all common and a significant number of students filled all the available space simply repeating these ideas.

Less than 10% of students gained credit beyond Level 1 and were able to show detailed understanding by linking ideas of increased availability of a named resource and how this enhanced growth (and thus yield) of the GM soya. The most commonly described routes were of the GM soya having access to more light for photosynthesis to produce glucose or for more access to a named mineral ion and its role in plant growth (commonly magnesium and/or nitrate).

One significant misunderstanding of what was required was by those students who often used at least half the available space describing how genetic modification is carried out, for no credit, as this had not been requested.

Those students who used the information along with their own knowledge generally scored high marks, but there were very many who failed to score more than one mark.

09.2 This was the last question on the paper and students might reasonably expect it to be set at high demand and thus the need for them to give details in their responses. Over half of students were able to give at least one reason why some people are concerned about the use of GM soya bean plants.

Whilst many referred to 'effects', either short-term or long-term, a significant proportion of these students omitted to link this to who, or what, might be affected. A reference to 'animals' or 'humans' was required to gain credit here, rather than potential effects on the plants themselves. Thus, terms such as 'when consumed' were sufficient if linked to effect, to gain credit.

A few students referred to possible changes to the taste of the GM beans, whilst others described a reduction of biodiversity. However, on this latter point, a 'reduction in variation' was not credited, often also being linked incorrectly to the idea that all crops could be wiped out by a single pathogen. Students should be aware of the difference between 'variation' (differences within a species) and biodiversity (the range of different species in a habitat).

Simply 'increased cost' was also insufficient to gain credit, students needed to indicate what that cost might be, either for purchasing seeds or the cost of the product to consumers. It was rare for students to refer to ethical concerns or to religion which had been excluded by the rubric, although some students did refer to the use of GM foods as being 'not natural'.

It should be noted that the question did not refer to the use of glyphosate, only to GM soya, thus, descriptions of polluting effects of glyphosate or the potential for it to be toxic when consumed, were ignored.

Mark Ranges and Award of Grades

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