
GCSE COMBINED SCIENCE: TRILOGY

8464/B/2H
Report on the Examination

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General

With the increased level of demand of this paper from the legacy specification, to examine biology and scientific skills up to grade 9, it was even more noticeable than that a large number of students did not access the questions set and so scored low marks. These students may have been better suited to sit the Foundation Tier paper where they would have had a safer chance to show their knowledge and skills and still achieve up to grade 5.

There were some questions where students gave a 'prepared answer' which did not actually fit the question asked and so they did not gain credit. Examples were:

- providing an answer about genetic modification to a question on selective breeding,
- discussing details of drug trials or vaccination for the question on how to prevent antibiotic resistant bacteria developing
- describing the trends seen in a graph when it was the interactions and functions of hormones in the menstrual cycle that was required.

It is also clear that the increased emphasis on mathematical skills in science has benefitted some students, but not all. Students need to make sure that they understand the limited range of mathematics needed for biology and practise these types of questions.

Required Practical Activities were assessed in this paper and it appeared that some students were not aware of the significance of these. These questions did not score high marks as students did not appear to have understood:

- the methods
- the equipment being used
- the concepts of independent, dependent and control variables
- validity.

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.

Question 1 (standard demand)

- 01.1** 86% of students were able to identify two or three factors that were biotic or abiotic, with about 64% identifying all four correctly.
- 01.2** Most students noted that light increased as you moved away from the tree. However, a much lower number related light to photosynthesis and fewer still could link to glucose for growth, although some answered with 'providing food'. There were students who mixed up photosynthesis and respiration.
- 01.3** Many students identified a quadrat and most of these could spell it correctly. Much fewer identified the light meter, with solar panel and light dependent resistor (LDR) as the most common wrong answers. 'Lightometer' was seen but unless this was qualified as a mobile phone app it did not gain credit. Similarly a 'light sensor' was only correct if linked to a data logger.
- 01.4** Most students attempted a calculation, with 15% answering correctly. Some students were able to correctly calculate the area of one quadrat as 0.25 m^2 but then multiplied by either ten or five instead of the six sites sampled.
- 01.5** A wide variety of answers were seen suggesting that students understood that light intensity could change during the day. Provided the idea was clear credit was awarded.
- 01.6** The many students who just wrote 'repeat the investigation' did not gain credit. However 38% of students knew that this would only improve validity if it was in a different direction or for a different tree. Sampling every metre was also a correct common response.
- 01.7** 74% of students identified 'daisy'. A number of students wrote more than one answer and so lost the mark under the list rule. Clover was a common incorrect answer, possibly because that was the species with the highest percentage cover at high light intensity rather than the species which **only** grew at high light intensity.
- 01.8** The first straightforward mark point for increasing light intensity showing an increased percentage cover of plants was stated by 62% of students although some incorrectly inferred that it was the percentage cover of plants causing the increased light intensity.

Only the most mathematically astute students were able to note that a maximum of 100% cover was seen from 175au of light for the second mark. A number of students did not read the question carefully enough and gave detailed descriptions of what was happening for each species instead.

- 01.9** While 69% of students were able to identify a factor for one mark, often seen and credited within the reason section, very few were able to explain this in terms of the tree. Instead students gave very general reasons for why the factor was needed by plants. Many students wrote about the carbon dioxide level under a tree changing which is not the case.

Question 2 (standard demand)

- 02** This was an ‘extended response’ question, marked using a holistic ‘levels of response’ mark scheme. Students were asked to explain the advice that doctors should be given to prevent the spread of a new strain of *Pseudomonas*. They were told that infections caused by the strain occurred in hospitals and that they could only be treated with one antibiotic, fluroquinolone.

Most students who took this paper showed good appreciation of how best to prevent the spread of such an infection and achieved at least a level 2 mark (47% of students). There were some excellent answers which easily accessed the highest award within level 3 (2% of students).

Many students failed to supply good biological explanations for the precautions they gave and so restricted themselves to the level 2 criteria of attempted logical linking and a not fully clear account. Common examples of this were references to bacteria becoming ‘immune’ to the antibiotic, or even the patient becoming immune to the antibiotic and the bacteria becoming ‘stronger’ if they were not all killed. Basic hygiene rules to ‘stop the spread’ as given in the stem were restricted to level 1. Many students gave no relevant content (0 marks) because they suggested that all hospital patients, or everyone in the world, should be given the new antibiotic. Many thought that it should be used as a vaccine to immunise everyone.

There were several misunderstandings:

- The question asked for advice that should be given to doctors. Answers based on advice to patients rarely gained above level 1. Doctors are not responsible for developing vaccines, so answers that focused on this alone could not be given credit.
- Answers that suggested that ‘everyone should be given antibiotics’ because they are a protective, preventative measure were inappropriate.
- Bacteria may develop resistance to an antibiotic but not ‘immunity’. Some students also implied that that any bacteria remaining after use of antibiotics might simply be ‘stronger’.
- Some students believed that the ‘patient’ developed resistance to the antibiotic or that the ‘antibiotic became resistant to the bacteria’, as opposed to the resistance being developed ‘by the bacteria’ and ‘against the antibiotic’.
- Some students thought that antibiotic resistance only developed ‘over time’ and, therefore, suggested that antibiotics should only be administered for short periods. Others believed that dosage was significant and argued for either small or large doses of antibiotics to be given.

Question 3 (standard & standard / high demand)

03.1 Students were able to relate extremophiles to harsh conditions with 39% of students identifying one of the conditions and 54% identifying both.

03.2 64% of students identified enzyme C as the enzyme from bacteria in the cave.

03.3 Those students who selected the incorrect enzyme in question **03.2** were unable to get any credit for their answer to this question. Some who correctly picked enzyme C then incorrectly wrote about microbes living or surviving in the conditions rather than referring to enzymes still being active in these conditions.

Other students appeared to misunderstand the graph itself and presumed that the enzymes themselves had high temperatures or were acidic rather than the activity being greatest in those conditions. The word optimum was rarely used.

Those students who got the correct answer (28%) usually referred to 'enzyme activity at high temperatures'. Whereas the students who wrote about pH did not mention that the conditions were of low pH or high acidity, simply referring to it being acidic.

03.4 There were a few excellent answers from students who had a real understanding of this new aspect of the specification. However, in general students struggled with this question, with 12% not attempting it at all. 3% of students achieved three marks.

Many students did not know what the domains were. Students often wrote answers about kingdoms and phyla rather than the three domains. And there were many answers that suggested the domains were a way of classifying organisms in the environment with many references to producers, consumers, habitats, communities and abiotic and biotic factors. Many students confused the three-domain system with the Linnaeus system of classification and described that instead.

Other students described the three-domain system as referring to the conditions of an organism's environment, referencing the previous questions' use of pH and temperature. Some students also described food chains or predator prey relationships. Students were often able to achieve two out of the three marks for their descriptions of Eukaryotes and Prokaryotes. However, they often did not describe Archaea as 'simple' or 'primitive' bacteria, but simply as extremophiles.

Not many students received credit for marking point one as they usually just referenced classification based on characteristics rather than DNA or chemical evidence. The compensation mark was the marking point most often awarded.

03.5 24% of students answered this question correctly. Some did not recognise that the extreme conditions were the focus of the question and instead commented on the microorganism being found in the caves which had matching conditions to the graphs.

Common incorrect answers included that Archaea are primitive or old or that they survived in hot or dark or humid or acidic conditions without making reference to the fact that these conditions are extreme.

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

04.1 Of the 63% of students who achieved at least one mark, this was mark was usually for identifying gap P as a synapse. Far less were able to correctly label the relay neurone. Many students labelled Q as a motor neurone.

04.2 Most commonly students achieved one mark for describing electrical impulses or the diffusion of chemicals across the synapse, so the compensation mark was not often awarded.

Common errors referred to electrical messages, pulses or signals, instead of electrical impulses. Impulses alone was also insufficient to gain credit.

- Some students who knew that a synapse involved chemicals then did not mention that the chemical had to move or diffuse.
- Some students correctly used the term neurotransmitter but did not say it diffused or moved across the gap / synapse.
- Other students confused chemical and electrical impulses with answers such as chemicals diffusing along the neurone or electrical impulses diffusing across the gap often seen.
- Some students misinterpreted the question and compared the speed at which the information travels in a neurone and across a synapse.
- A few students referred to hormones travelling across the synapse rather than chemicals and a few students mentioned blood travelling down a neurone as if it were a blood vessel.

- 04.3** Few correct answers were seen on this question with 17% of students achieving the mark. Many simple answers related to one going to the brain and the other to the spinal cord or answers such as it being automatic or there is no thinking involved were commonly seen and were insufficient.

Lots of students wrote about the 'conscious action' or 'it' moving to the brain without being clear that it is the 'impulse' that is actually travelling to the brain. Some students seemed confused about the central nervous system and thought that both the brain and spinal cord are part of the CNS, and therefore suggested that the reflex didn't have to go the CNS. Many stated that you simply needed more time to think about it but made no mention of the brain.

Finally, many students simply said that reflexes were automatic or for our protection which is why they were faster.

- 04.4** Most students understood that in order to answer the question they needed to use the speed = distance ÷ time equation. But often did not rearrange it correctly and therefore divided 120 by 16.

The vast majority of students were unable to convert their answer into milliseconds to achieve marking point three and many did not attempt to. Those that did often multiplied their answer by 100 or 10 but rarely by 1000 and other students divided by 10 or 100.

When students did correctly gain the first marking point they usually also achieved the second (28%). It was very rare to award the compensation mark.

- 04.5** 74% of students were awarded the first marking point. Some students described the pattern as directly proportional which is clearly wrong and therefore they could not gain this mark.

The second mark was only seen by 2% of students. Lots of attempts were made to include data in the answer but they often just quoted data from the table or did simple subtractions of two numbers from the table.

Question 5 (standard / high & high demand)

- 05.1** The basic principle behind selective breeding was understood by a good number of students with 49% credited with at least one mark. However, they missed marks by not being precise enough in relating their answer to the particular context of this question. Many referred to ‘a bigger yield’ or the general ‘desired characteristics’ instead of short stems and large grains.

The question was often misread as a genetic modification (GM) question. Students who followed this route seldom achieved any marks. There were a lot of answers in terms of GM, cutting out enzymes, injecting genes, asexual reproduction and cloning. A large number wrote about breeding the plants together using asexual reproduction and generally showed little understanding of how asexual and sexual reproduction are different. Often these students would go on to talk about transfer of pollen being a part of the asexual process.

Marking points two and three were most often given. However, some students went on to incorrectly describe breeding as adding pollen to seeds. The most common error for marking point three was to breed all the offspring together rather than choosing the ones with short stems and large rice grains. If students answered a generic question instead of this one about IR8 rice they were still able to achieve a maximum of three marks.

In marking point four many students demonstrated an understanding of continuing to breed, but only a minority obtained the mark by also referring to an end point. ‘Bred true’ was not seen but ‘until IR8 is produced’ or ‘until all plants have this characteristic’ was noted. 3% of students achieved all four marks.

- 05.2** This high demand question was not well answered due to lack of biological detail in explanations. 4% of students achieved two or more marks. A great many students only provided half of any mark point. The compensation mark was awarded a few times, but was often missed because the ‘for’ response gave only the explanation, not the reason. Many students did not give explanations. Answers only listing statements or explanations tended to be weak suggesting that students were not as strong with regards to the issues surrounding GM.

A typical answer gaining no marks was ‘agree as can provide enough food to feed the population so less people are starving in India but disagree because it uses chemicals’.

Many students made references to unnatural, going against nature, against god, dangerous due to the use of chemicals, against religion, unethical, scientists playing god or the idea that an embryo is a potential life which is killed. Other ideas put forward which did not gain credit were rice producing methane which affects global warming, inbreeding causing diseases to spread so if one plant gets it they all will die and vague references to biodiversity.

‘Superweeds’ were mentioned occasionally, which if correctly described with reference to transfer of herbicide resistant genes a mark was achieved. Those students who referred to the concern about the effect on people’s health rarely gained the mark because they did not talk about ‘not enough research having been done yet’.

Question 6 (standard / high & high demand)

- 06.1** There were 16% correct responses to this question, achieved by reading correctly from the graph, followed by correct calculation and rounding.

However, a significant proportion of students misread the graph and so started with the wrong data. One mark was often achieved for giving their answer correct to two significant figures.

A large number of students did not to the rise in concentration of LH by time, although 'units per hour' was shown on the answer line. Many attempted to divide by days or minutes. Students also carried out the inverse calculation or tried to calculate percentage change.

- 06.2** 10% of students gave excellent, clearly set out responses gaining four or five marks. These students demonstrated that they had understood and learnt the quite difficult interactions of hormones during the menstrual cycle. On the other hand, many students wrote confused accounts or simply describing the levels from the graph, so this question discriminated well.

A number of students referred to the pancreas as the site of production for some hormones while others did not gain because they referred to the 'master gland' rather than the pituitary. Some answers did not relate to the menstrual cycle. These students may have only read the second part of the question, name where each hormone is produced, for which they listed as many as they could, including testes and testosterone, pancreas and insulin, adrenalin and adrenal glands, thyroid and thyroxine.

The compensation mark was awarded in a number of cases, although there were many who gave the location of the hormones as the pancreas, or got all but one correct. 51% of students did not achieve any marks.

- 06.3** This question was not well answered with 'not having to remember to take the pill every day' being the most frequent correct response. There were many insufficient responses about it being more effective, longer lasting or being safer.

There was some confusion regarding how both patch and pill are used. Some students thought the patch was placed inside the vagina, in the mouth or on ovary. Others thought that it would reduce the risk of STDs, or that it is easy to remove if you want to get pregnant.

Question 7 (standard, standard / high & high demand)

As expected with this question being higher demand, students generally achieved lower marks. Some excellent answers were seen where students were able to access knowledge from different parts of the specification as well as use information from the question stem and their own wider reading to express complex concepts.

07.1 This was not a straightforward knowledge question as students needed to use logical thinking as well as knowledge of chromosomes to work out the correct alternative. 50% of students arrived at the correct response. Many realised that there would be one X and one Y chromosome but their maths let them down when they computed that only eight more pairs would be needed.

07.2 A large number of students understood meiosis was the type of cell division and many students could not spell it correctly. Being able to understand the differences in mitosis and meiosis is crucial as is being able to correctly spell all keywords. 28% of students achieved two or three marks.

07.3 Students seemed to struggle with the idea that meiosis created four daughter cells from the two divisions, although they did tend to identify that the cells would be haploid. Many just stated the cells would be not identical rather than being genetically different.

The majority of students found it difficult to transfer their knowledge of humans and their 23 pairs of chromosomes to oysters with ten pairs and so their answers were confused. 19% of students achieved the mark here.

07.4 While students were able to note that triploid oysters didn't spend time reproducing, very few related this to energy. Many went down the route of not needing time to look for a mate. The few that did identify energy and reproduction (6% of students) rarely linked the energy available to synthesising proteins, and instead going with vague references to 'growth' which is insufficient at this level.

07.5 Students had the idea that global warming, pollutants, competition or predators could be involved, but rarely gained credit as they did not express this with the necessary high demand biological detail required to explain how it would lead to a reduction in population.

Key points were generally missing such as toxic pollutants and new predators or pathogens. Some students mentioned disease but did not relate it to pathogens. 3% of students achieved full marks.

07.6 This ‘extended response’ question was targeted at grades 6–9. Many students were able to access level 1 (43%) and level 2 (27%). It served its purpose of allowing the higher-attaining students to perform well, while not discouraging lower-attaining students from answering, and very few students made no attempt.

It was felt that students engaged with the opportunity to have an opinion about ideas on whether supermarkets and restaurants should be allowed to stock a product which may have a link to a carcinogen.

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.