Questions matter

GCSE

Combined Science: Synergy

8465/2H Paper 2 Life and Environmental Sciences Higher Tier

Report on the Examination

8465
June 2024

Version: 1.0

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General comments

Nearly all questions were attempted by all students and there were some informed answers that demonstrated a breadth of knowledge and understanding.

Problems encountered included:

- chemistry and physics questions on this paper not being answered as well as the biology questions
- poor handwriting made some answers illegible
- multiple lines of best fit when drawing graphs with no indication of which one to mark. This could be avoided by using a pencil and rubber rather than pen
- the understanding of Required Practical Activities, including why method steps were used.

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 and 2 are common with questions 8 and 9 on the Foundation tier. These questions are identical with each other and are targeted at standard demand.

Question 1 (standard demand)

This question assessed student's knowledge of Required Practical Activities, methods and apparatus used in chemistry experiments.

01.1 The students were asked to use a results table to suggest how the pH in two different methods was measured. Over half of all students scored one or more marks for this question. Common incorrect responses for method A were pH paper or pH solution. This was not sufficient for the marking point. pH tester or pH reader were also not sufficient responses for method B.

01.2 Over half of students knew that each method gave values to different resolutions so it would not be valid to calculate a mean. Over a third of students incorrectly thought you could calculate a mean for each method using all four samples.

01.3 This question tested the students understanding of practical terminology and was not answered well with less than a quarter of students achieving a mark. Accurate was the most common incorrect answer.

01.4 Students had to interpret a table of results to say which river was most likely to be in an area with a high concentration of sulfur dioxide in the air. Almost half of all students correctly selected river X as the river most likely to be in an area with a high concentration of sulfur dioxide in the air. The most common incorrect answer was river Y.

01.5 This question required students to explain why they had chosen a particular river as being in an area with a high concentration of sulfur dioxide in the air. Over two fifths of students achieved one or more marks for this question. Students who had selected river X in their previous answer often also realised it was because river X was acidic.

Students who incorrectly said river Y sometimes incorrectly thought it was because the higher the pH the more acidic it was. Very few students achieved marking point 2. Students who thought sulfur dioxide dissolved into the river could not achieve this mark as it needed to be clear a chemical reaction was taking place in the air. Several students realised the connection between sulfur dioxide and acid rain to gain marking point three.

01.6 Students had to describe a method for one of the chemistry Required Practical Activities. Most students recalled the method that needed to be described with almost half of the students achieving Level 1 for this question. Distillation and only describing filtration were common errors which were not sufficient.

Students that described the correct method sometimes forgot to measure the initial mass of the evaporating dish and so the mass of dissolved solids could not be calculated. A valid outcome could not be reached so students could not access Level 2 if they missed out this key method step.

Question 2 (standard demand)

This question was assessing students' knowledge of biodiversity, practical ecology methods and practical techniques.

02.1 Over half of all students achieved one or more marks for this question. Most students who scored one mark did so by describing how to generate a random number. Answers such as picking a number out of a bag or rolling dice were examples of correct descriptions of how to obtain random numbers. Few students achieved two marks. They often realised they used random numbers to determine coordinates did not describe how those coordinates would be devised.

02.2 This question was answered well with almost two thirds of all students achieving a mark. Some students gave reasons for why animal biodiversity increased rather than answering the question so could not achieve a mark.

02.3 Less than a quarter of students achieved a mark. Incorrect answers varied but it was clear that the linear equation was not well understood.

02.4 This question was answered well with most students answering in terms of the number of plant species on living grass rather than the lack of plant species on plastic grass.

02.5 Two fifths of students achieved both marks. Several students incorrectly thought repeating the experiment three times at different times of the day would improve the experiment. The most common correct answer was recording the number of plants of each species as well as the number of species.

02.6 This extended response question was separated into statements regarding how plastic grass decreased biodiversity and increased biodiversity. Students did not have to refer to both biodiversity increasing and decreasing to achieve full marks. Students rarely referred to plastic grass increasing biodiversity.

Almost half of all students achieved Level 1 and almost a quarter achieved Level 2. Most students commented on the plastic entering the rivers causing animals to eat it. Often students who achieved Level 2 did so by then connecting this to food chains. Answers referring to light being blocked, blocking animal access to the surface and there being less decomposers due to less soil were rarely seen.

02.7 Over three quarters of students achieved a mark for knowing that smaller populations are more likely to become extinct as less genetic variation is a greater risk if the ecosystem changes.

02.8 Over three quarters of students achieved one or more marks for stating how to increase biodiversity in and around fields. The most common correct answers were to plant more trees or plants. A common incorrect answer was to introduce animals to the area by giving food. This was insufficient as for animals to come to obtain food they would already have been present in the area. This therefore would not increase biodiversity.

Question 3 (standard & standard/high demand)

This was a physics question that assessed knowledge of physics experiments and the electromagnetic spectrum.

03.1 Most students correctly said UV waves were used in sun tanning. Many students incorrectly thought radio waves were used for satellite communications. Incorrect answers for sterilising surgical equipment varied and included microwaves and infra-red.

03.2 This was not answered well with over half of students not scoring a mark for this question. Very few students said that distance is a control variable. Many students achieved the second marking point, but they expressed it in various different ways. Correct answers such as the closer the thermometer the more infrared it received were common. For this question heat or heat energy was equivalent to infrared radiation as it was a heater that emitted the infrared.

03.3 Most students correctly identified the risk with over two thirds of students achieving one mark or more for this question. The most common incorrect response for the precaution was to wear gloves which was not creditworthy.

03.4 Students were asked to explain a conclusion based on a graph of student results. Almost half of all students achieved one mark with a tenth achieving both available marks. Students who achieved one mark usually did not state that black surfaces are better absorbers of infrared. Students who only quoted values off the graph did not achieve the first marking point. It needed to be clear that the total temperature increase or temperature change was greater for the black thermometer than the white.

03.5 Students had to draw a line on the previous graph to predict a set of results for a shiny silver surface. Most students achieved the first marking point. Most incorrect responses for marking point 2 drew the line for shiny grey paint between the graph lines for white and black paint. Most students knew the line had to have a positive gradient.

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

This question started with a chemistry question but then tested their biological knowledge of carbon monoxide's effect on the body along with interpreting graphical data.

04.1 This question was not answered well with a quarter of students scoring a mark. Most students described the structure of carbon monoxide rather than how it was formed. Students that achieved one mark had normally correctly stated that incomplete combustion produced carbon monoxide.

04.2 Less than a quarter of students achieved a mark. Many students stated the adaptation of the red blood cell but did not go on to describe how this adaptation helped it to function. Students who achieved one mark usually did so by saying a lack of nucleus so the red blood cell could contain more haemoglobin. Vague statements such as increased surface area for more oxygen were often seen and were not creditworthy.

04.3 The majority of students correctly read the graph with less than a fifth of students not scoring a mark.

04.4 This question tested graph drawing skills and was answered well with over half of all students achieving all the marks available. Most students who attempted the line of best fit did draw it as a curve but sometimes it was not smooth enough to be awarded the mark. An example of common incorrect lines of best fit were where students had drawn multiple lines and not specified which one to mark.

04.5 Students had to use the data given and their own knowledge to suggest the symptoms of a low carbon monoxide concentration. Most common correct answers were dizziness, tiredness and faster breathing rate. Few students commented on the faster heart rate.

04.6 This question asked students to explain the effects of a high concentration of carbon monoxide. This was not answered well with very few students achieving the third marking point and just less than two thirds of students not achieving any of the available marks. References to energy being created were sometimes seen and are incorrect. A lot of students knew that carbon monoxide decreased the amount of oxygen in the body but could not articulate that it was due to the haemoglobin or red blood cells transporting less. Answers which said there was no respiration occurring could not be awarded marking point two as this would cause the death of the person.

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

This was a physics question based on radioactivity but also requiring students to interpret experimental data.

05.1 Over two thirds of students correctly stated that genes can be mutated by ionising radiation.

05.2 This was answered well with almost all students achieving both marks. Most students who scored one mark gave the incorrect value for helium.

05.3 Students had to interpret data to calculate the difference in number of nuclei of two isotopes after a certain length of time. A quarter of students achieved two or more marks for this question. Several students confused 210 as the number of nuclei that bismuth had and 214 as the number of nuclei lead had. Most marks were gained for calculating the number of half-lives that had passed in 5 days for each isotope. Some students referred to the number of nuclei for each isotope after 5 days but very few went on to compare the nuclei to achieve marking point five.

05.4 Percentage increase was not understood well with a third of students knowing there was a 440% increase in actual number of cases compared to predicted number of cases. Over half of the students thought there was a 540% increase in actual number of cases compared to predicted number of cases.

05.5 A third of students achieved one or more marks for this question which asked for an explanation as to why the actual number of lung cancer cases was higher than predicted. Most students who achieved one mark did so by realising the miners were breathing in the radon gas. Very few students said that the alpha particles did not penetrate the skin. Comments such as the alpha particles did not enter the body were insufficient. Several students recognised that alpha radiation was highly ionising and so achieved marking point 3, but rarely did they go on to connect this to why the numbers of lung cancer were greater than expected.

Question 6 (standard/high & high demand)

This biology question assessed understanding of water transport through plants, the osmosis Required Practical Activity and magnification calculations.

06.1 This question was not answered well with less than a twentieth of students scoring all three marks. Students often described the pathway of the water through the plant but omitted the structures and processes that the water passed though. This was insufficient. Some students confused the uptake of water at the roots with ions stating it entered by active transport. Very few students referred to the root hair cells so did not achieve the first marking point. Students who scored one mark mainly achieved it through saying water was transported in the xylem. Transpiration or evaporation from the leaves was rarely mentioned in student answers.

06.2 Unit conversion and a magnification calculation was being assessed in this question which was answered well with almost a third of students receiving all five marks. The most common error was a failure to correctly convert the units. A few students did not rearrange the magnification equation correctly.

06.3 Less than a tenth of students achieved a mark for this question with many students thinking the pepper was kept at 5 °C prior to the investigation as a control. Several students also thought it was to stop the sugar solution from evaporating which was incorrect. Non-scientific words such as rotting were often seen and could not be credited.

06.4 The reason for using percentage change in mass for this method was not understood well, with less than a tenth of students scoring a mark. The most common incorrect answer was to make it more accurate. Some students said they had different starting sizes. This was insufficient as the method clearly stated the size was controlled.

06.5 Almost half of all students correctly used the graph to determine the concentration of solution inside the pepper cells. The most common error was reading the percentage change in mass at a concentration of 0 mol/dm^3 sugar solution.

06.6 Almost four fifths of all students did not score any marks for this question which asked students to explain the percentage change in mass of the pepper at a specific concentration. Many students misinterpreted the question and answered by giving the mean percentage change in mass value for 0.5 mol/dm^3 sugar solution. This received no marks. Some students answered in terms of the *sugar* moving out of the cell rather than *water* moving which was incorrect.

Comparisons between the concentration of water inside and outside the cell was rarely seen so marking point two was rarely awarded. Students who knew water had left the pepper sometimes omitted how it left so could not achieve the first marking point.

06.7 This was not answered well with many students thinking the cell walls were wrinkled to stop the cell from bursting or students simply stating that the cell was under-developed. This was copied from the stem of the question so was not creditworthy.

Question 7 (standard/high & high demand)

07.1 This question assessed the students understanding of genes and was not answered well with few students gaining two marks. If a student achieved one mark it was usually for stating genes code for different proteins.

07.2 Students who drew a Punnett square diagram for this question were more likely to achieve the first 3 marking points. Some students were confused by thinking the male chromosomes were YY which meant they could not achieve the first or third mark points. Very few people achieved the fourth marking point. It had to be clear they were talking about large numbers of offspring not just a 50% chance of each gender every time you have a baby.

07.3 Over three quarters of students could not correctly suggest why genetic modification of human embryos is illegal in most countries. The most common correct answers were an example of long-term side effects or ‘designer babies’. Many students were confused about genetic modification of an embryo thinking the embryo would be destroyed. Vague statements such as ethics or religion were often seen and were insufficient for the mark.

07.4 Whilst students realised the gene needed to be cut out, in order to genetically modify the embryo, they did not state it was using enzymes so did not achieve the mark. Over three quarters of students did not gain credit.

07.5 Common incorrect responses were animal cells, red blood cells and eukaryotic cells with over three quarters of students not achieving a mark.

07.6 This question asked what type of drug is used to treat HIV. Common incorrect responses were vaccines and antibiotics. Anti-viral drug was commonly seen but was not specific enough for this high demand question so could not achieve the mark.

Question 8 (standard, standard/high & high demand)

This high demand biology question assessed food tests, enzymes, heart disease and drug development in an unfamiliar context of funnel-web spider poison.

08.1 Students who correctly said biuret is the solution to detect protein usually also achieved the second mark for the colour change. It was answered well with over a third of students achieving both marks for this question. Common incorrect answers were iodine solution and Benedict's with a varied range of incorrect colour changes.

08.2 This question tested students' knowledge of how enzymes work and where they are produced. Many students realised that the spider poison was in the blood with over a quarter of students receiving a mark for this question. Several students correctly stated that the protease enzyme may not be specific for the poison. There was confusion over the organs that produce protease. Incorrect answers such as the mouth and liver were commonly seen.

08.3 Students were asked to explain the decreased oxygen concentration in heart muscle tissue caused by coronary heart disease. Most students achieved a mark by saying there was a build-up of fats in the arteries. Incorrect responses such as fatty acids building up were occasionally seen. Many students thought the decreased oxygenated blood flow was coming from the heart rather than supplying it. Marking point 2 was not awarded for this.

08.4 Students had to use prior information and the stem of the question to suggest a reason for a new drug being useful in transporting the donor heart for heart transplant purposes. Less than a tenth of students answered this correctly. A lot of students repeated the stem of the question with no extra information so could not access the mark. Often students did not relate transportation to the need for the heart to function at lower oxygen concentrations. The most common correct answer was that the heart could be transported further as it had less oxygen.

08.5 This extended response question required students to use all information from the previous question parts along with their own biological knowledge. Almost half of students achieved Level 1. To access Level 2 students had to give a least one advantage and two disadvantages. Less than a tenth of students achieved Level 2.

A lot of students repeated information previously given in the question without adding any extra information which was not creditworthy. A few students misunderstood the question and thought the drug was against the spider toxin. Students who had this misconception gave accounts on how vaccines work which again was not creditworthy. Most students gained 1 or 2 marks by only listing disadvantages of the drug which meant they could not access Level 2. Common correct disadvantages were unknown side effects, extinction of the spiders and difficulty in sourcing the drug from the wild. Very few students commented on the need to synthetise the drug or farm the spiders to improve the supply.

Mark Ranges and Award of Grades

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