GCSE
COMBINED SCIENCE: TRILOGY

8464/B/1H
Report on the Examination

8464
June 2018

Version: 1.0

Further copies of this Report are available from aqa.org.uk

General

There were 6 questions on the Higher Tier paper. Questions 1 and 2 targeted grades 4–5 and were common with the Foundation Tier paper. Questions 3–6 mainly targeted grades 6 and above.

Practical skills must be assessed in the question papers. Paper 1 covers five of the seven Required Practical Activities. These should be used to teach skills related to:

- planning investigations
- the different types of variable
- use of apparatus
- identifying errors in methods and suggesting improvements
- presenting and analysing results.

These skills can then be applied to different investigations. It was noticeable in the quality of response when a student had a good practical understanding.

Students demonstrated good maths skills, including plotting graphs. Some students found interpreting graphs more difficult.

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 Students demonstrated a good understanding of prokaryotic and eukaryotic cells. 87% of students achieved two marks. To gain both marks all three structures had to be correctly linked to the type of cell where each structure is found.

When only one mark was awarded it was usually for identifying the nucleus as being found in eukaryotic cells.

01.2 Students demonstrated a good understanding of cell structure. 80% of students were awarded the mark for identifying the vacuole, ribosome and cell wall in the plant cell.

Students were asked to tick one box, but some labelled the diagram, whilst others circled the names of the structures in the table.

01.3 27% of students achieved this mark. The cells on slide A appeared large, but blurred. The required response was a reference to focusing the image.

Many students referred to zooming in or out, to altering the magnification or using an electron microscope. All of these were ignored. However, if they said increase the magnification this was incorrect and negated a correct answer of focusing the image.

01.4 The cells on slide B appeared small but in focus. The required response was a description of how to obtain a larger image. There were two marks available for this question.

- One was for reference to changing the lens.
- One was for stating that the new lens would have a higher power or magnification.

45% of students obtained a mark. Where a mark was awarded it was usually for saying increase the magnification.

Changing or using a better magnification was insufficient. Many students referred to zooming in or out or said use an electron microscope, both of which were ignored.

01.5 There were three marks available for this question.

- The first mark was for conversion of units. Many students did not attempt a conversion but could still go on to achieve two marks. A range of different errors were made which included multiplying or dividing by 10, 100 or 10 000, rather than by 1000. Some did not appreciate that a micrometre is smaller than a millimetre.
- The second mark was for correctly substituting into the rearranged equation to calculate magnification. This mark was allowed even if their initial conversion was incorrect.
- The final mark was for an answer of 400. Some students added a unit to their answer and this negated the mark.

33% of students achieved all three marks, and 33% achieved two marks. 24% of students scored zero. This was often for 280 ÷ 112 = 2.5

Question 2 (standard demand)

02.1 Few students scored the first marking point for saying that a non-communicable disease is not caused by a pathogen. Some students gave examples of non-communicable diseases, such as CHD, diabetes and cancer. Others gave a cause, such as genetics, lifestyle or diet. These were ignored.

89% of students achieved one mark, usually for saying a non-communicable disease cannot be caught or is not infectious. 5% of students achieved full marks.

02.2 The majority of students gained the first marking point for stating that blood flow is reduced in people with CHD.

For the second marking point it had to be clear that this would result in less oxygen reaching the cells of the heart, as the question asked how CHD can cause a heart attack. Many students wrote about less oxygen reaching other parts of the body.

The last marking point needed a link to less respiration or insufficient energy release. Students often incorrectly referred to less energy being made, created or produced.

There were very few three-mark answers seen (2%). Of these, some gave a complete story linking reduced respiration to there being insufficient energy released for the heart muscle to contract.

02.3 This was a 'level marked', 'extended response question'. The command word was 'Explain', so the main discriminator between the three different levels was the quality of linking ideas. Students were asked to explain how lifestyle and medical risk factors increase the chance of developing CHD. Therefore examples of both types of factor had to be included, with several examples of logical linking of ideas, in order to enter level 3. 77% of students achieved a minimum of three marks. 41% of students gave a level 3 response.

Many students phrased their response in terms of how to reduce the chance of developing CHD, which could achieve full credit if explanations were included. References to doing exercise and not eating too many fatty foods were often seen, but if these were not linked to explanations the answer was limited to level 1. References to bad or unhealthy diets were too vague without going on to mention high levels of fat, sugar or salt.

An answer such as a fatty diet and not enough exercise can lead to obesity, which increases the chance of CHD, gained 3 marks as there is an attempt to link ideas. To be awarded 4 marks better links had to be made, or more factors referred to. Smoking and alcohol consumption were sometimes mentioned. With reference to smoking, a number of students were under the impression that smoking leads to the build-up of tar in the coronary arteries.

Many responses were limited to level 2 because there was no reference to any medical risk factors. Where medical factors were included it was often in relation to diabetes or genetic factors. A family history of heart problems was sufficient for this idea. High blood cholesterol was sometimes given as a medical risk factor.

Question 3 (standard, standard / high & high demand)

03.1 85% of students selected the correct balanced equation for photosynthesis. The most common incorrect equation selected was that which represented respiration.

03.2 This question tested a new part of the specification. 49% students identified photosynthesis as an endothermic reaction. 25% of students thought photosynthesis was an aerobic reaction, and fewer said it was an exothermic reaction.

03.3 The question asked for two ways to measure the rate of photosynthesis more accurately. 8% of students achieved both marks, with 46% achieving one mark. This was usually for measuring the volume of gas released. Quite a lot of students suggested ways to do this, such as using a gas syringe, which was awarded a mark.

Relatively few students suggested increasing the length of time to collect the bubbles and some thought reducing the time would make the results more accurate.

Alternative ideas that gained credit included:

- using a video so the bubbles could be recounted afterwards
- repeating the measurements and calculating a mean (the whole of this statement was required for a mark).

Many students suggested carrying out the investigation using different distances, light intensities or sodium hydrogen carbonate concentrations, all of which were ignored.

03.4 The question asked why the pondweed had to remain at a constant temperature. 3% of students achieved both marks, and 54% were awarded one mark.

For the first marking point a reference to the effect of temperature on the rate of photosynthesis was required. Statements such as 'temperature affects photosynthesis' were ignored.

The second marking point was for stating that photosynthesis is controlled by enzymes, or that high temperatures denature enzymes.

03.5 62% of students achieved two marks for the correct calculation of $1 \div d^2$ for two distances that doubled. Calculations for all three distances were often given. Although the question said calculations **must** be included, quite a lot of students did not attempt any.

Students found the final mark, for explaining that as distance doubled the light intensity was quartered, the most difficult to express. For example, reduces by a quarter or decreases by four were incorrect. Many did not give a quantitative description, and said as distance increased light intensity decreased. This was insufficient.

03.6 50% of students were awarded the first marking point for predicting that two bubbles would be produced. This was the only answer allowed. Common incorrect responses were zero, one or four bubbles. 195 of students achieved both marks, as students found it difficult to give a reason for their prediction.

03.7 Many students did not understand the term independent variable. Many of those who did, gave insufficient information to achieve the mark. They often said change the concentration of carbon dioxide, but did not describe how this could be done. Some suggested using different volumes of sodium hydrogen carbonate solution, but a reference to changing the concentration was needed.

The term control variable was better understood, but students did not always gain credit because their descriptions were too vague. For example, keep the light or lamp the same was insufficient. A reference to light intensity or the distance from the light source was needed. Temperature unqualified was ignored. It had to be clear that it was the temperature of the solution that should be controlled.

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

04.1 9% of students understood why the percentage change in mass was calculated. A clear reference to the starting mass of the carrots being controlled, or that the carrots were not all the same mass at the start, was needed.

Quite a lot of students referred to being able to compare the carrots, which was insufficient. Some restated the title of the investigation, and said so that the effect of different concentrations of sugar solution on the carrot could be seen.

04.2 When plotting graphs, it is advisable to use a pencil so errors can be erased.

93% of students achieved a minimum of two marks, with 22% achieving full marks. Common mistakes included:

- forgetting to label the *x*-axis
- using an inappropriate scale, which made plotting very difficult
- plotting dots instead of crosses; dots cannot always be seen
- drawing a line of best fit which did not average out the data.

Most students chose a scale of 2 cm to 5% which was the most sensible option. Those choosing 1 cm to 5% did not gain the scale mark as less than half of the available space was used. Some students used a scale of 1 cm to 3 % which was acceptable.

Students should be aware that a line of best fit can be a curve or a straight, ruled line. The data provided formed a gentle curve. Approximately 10% of students drew a curve through all the points, which was correct. Those who drew a straight line could still be awarded the mark, as long as it averaged out the data. Very thick lines or sketchy, double or broken lines were insufficient.

04.3 Students had to read the value from their line where the percentage change in mass was 0. A tolerance of ± ½ a square was allowed.

33% of students correctly estimated the sugar concentration from their graph. A number of students gave an answer of 0.4 mol/dm^3 despite their line passing through a concentration greater than this. Other common incorrect answers included 0.2 and 0.8 mol/dm^3. Some students incorrectly read the scale, reading 0.46 as 0.43 or 0.42 as 4.2

04.4 55% of students achieved at least one mark, but only 27% achieved two or more marks. There were a few very good responses which demonstrated that the definition for osmosis had been learnt. Quite a lot of good answers only scored three marks because they did not mention that the mass decreased. Others did not mention the partially permeable membrane.

For the second marking point diffusion was ignored, as at high demand students are expected to know that water moves by osmosis. A few thought that water moves by active transport. Some thought that it was sugar that moved by osmosis.

Some responses included confused references to concentration. It was not clear whether students were talking about water or sugar concentration. Some switched between water concentration and sugar concentration. Those who expressed concentration in terms of dilute and concentrated solutions generally gave clearer responses.

Incorrect ideas that were seen included:

- the carrot filling up with sugar and bursting
- gas being given off
- bits falling off the carrot as it dissolved
- enzymes breaking down the starch.

04.5 3% of students achieved this mark for this question targeted at grades 8–9. Many students appreciated that the high temperature would damage something in the cell. In order to gain the mark they had to refer to the membrane.

Damage to the cell or to enzymes was often stated. Saying osmosis could not happen or the cells were dead were both insufficient. Some thought that water would not be able to enter or leave the cell, which was incorrect.

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

05.1 76% of students achieved this mark. Common correct responses included not all cases of measles being recorded or diagnosed, or people not going to see the doctor. There were some confused ideas that deaths would not be recorded.

05.2 34% of students were awarded both marks. The most common error was in rounding the final answer, for example an answer of 95 gained one mark only.

Quite a lot of students used the alternative method given on the right hand side of the mark scheme. Many gave an answer of 4.5% for one mark. Only a few continued and subtracted this value from 100 to give the correct final answer.

05.3 This was a demanding question targeting the highest-attaining students. 8% of students achieved at least one mark. The question asked for an explanation of why vaccinating a large proportion of a population reduced the spread of the measles virus.

The first marking point required a reference to most people being immune and linking this to the fact that they would not become ill. Students usually missed this mark because they said they would not catch the virus, which is incorrect. Many were familiar with the term ‘herd immunity’, but few could clearly explain it.

The second marking point was for the idea that there would then be fewer people with the disease to pass the virus on to unvaccinated people. This mark did need a reference to the chance of an organism being passed on, disease was insufficient.

Many responses included correct biological facts, but they were not relevant to the question being asked. For example, many students gave a description of what a vaccine is, or described the immune response in general terms.

05.4 This was a 'level marked', 'extended response' question. The command word was 'Explain', so the main discriminator between the three different levels was the quality of linking ideas. Students were asked to explain the differences between antibody production after the injection of a vaccine and after exposure to the measles virus. Therefore comparisons between the two exposures and clear explanations in terms of the immune response were needed for level 3.

Students who only gave simple statements or a description of the graph, without comparisons or explanations, could only attain level 1. 53% of students gave a level 1 response.

Some students only gave comparisons. These could achieve three marks, if sufficient comparisons were made. The most common comparisons given were that more antibodies were produced at a faster rate after exposure. On their own these comparisons achieved two marks. If a correct quantitative statement was also given this was sufficient for three marks.

To achieve four marks explanations for the differences were required. 34% of students achieved three or more marks. Very few students gave a level 3 response, but this was targeted at grades 8–9.

Many responses showed a misunderstanding of antibodies, antigens, antitoxins and phagocytosis. Incorrect graph readings were often seen.

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

06.1 26% of students achieved the mark for saying stem cells are found in meristems or the tips of roots or shoots. A variety of incorrect organs or tissues were named, the most common being root, stem, xylem and embryo. Some students named parts of a cell, such as chloroplast or cytoplasm.

06.2 49% of students correctly identified producing a large number of identical plants as one economic use of plant stem cells. There was some confusion of genetic engineering and stem cell technology, as most other students selected to create genetically modified crops as their answer.

06.3 This question was targeted at grades 8–9. 4% of students correctly converted 6 picograms into grams and wrote the answer in standard form.

Some students did not understand the term standard form and gave a number written in decimal form. This value was usually an incorrect conversion of picograms to grams. Common incorrect attempts at writing the value in standard form included 6×10^{-6} or 6×10^{-9}

06.4 15% of students achieved both marks for calculating the number of hours the cell spent in mitosis and giving the answer to three significant figures. 20% of students achieved one mark because they rounded the number incorrectly or gave their answer in hours and minutes. Many students referred to both 28 and 15 but used an incorrect calculation or did not realise there are 360° in a circle.

06.5 14% of students achieved more than two marks. The majority of students gained a mark for stating that the cell would grow during stage 1, or two copies of each chromosome form. The latter of these events was often included in stage 2, rather than stage 1. This error, or if stage numbers were omitted, limited the response to a maximum of four marks.

Some very good descriptions of mitosis, including spindle formation, were seen. However, a lot of students did not mention the nucleus dividing. A few students gained the final mark for saying cytokinesis occurred in stage 3. Few gave the full description of the cytoplasm or membrane dividing to form two identical cells.

42% of students did not achieve any marks. This was usually because they described the process of IVF. Some confused the cell cycle with meiosis and fertilisation.

06.6 31% of students achieved two or more marks.

Marks were generally awarded for advantages, rather than disadvantages. Common correct advantages given included:

- how stem cells can be used in patients
- diseases stem cells can be used to treat, for example paralysis
- that the cells would not be rejected by patients.

The most common disadvantage mentioned was that an embryo or potential life was destroyed. Saying the cells were wasted was insufficient.

A lot of students confused the process with that of IVF.

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.