GCSE

COMBINED SCIENCE: TRILOGY

8464/C/2H Paper 2 - Chemistry (Higher tier)
Report on the Examination

8464
June 2022

Version: 1.0

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

General

This paper was more accessible than the last comparable paper in 2019, with the mean mark on the paper increasing by 3.

Questions one and two were common to Foundation and Higher tiers and were targeted at standard demand.

Students should be prepared to expect that they will be given unfamiliar contexts and information. Familiar contexts are those mentioned in the specification and assess recall, selection and communication of students' knowledge and understanding. The mark scheme was designed to allow students to gain marks for showing knowledge, understanding and application of chemistry. Knowledge and understanding in familiar and in unfamiliar situations, including in the laboratory, are tested throughout this paper. This means that it is essential that students read and analyse the information provided, then read and understand the question before writing their response.

This report should be read in conjunction with the published mark scheme.

NB there was an error on the 18pt A4 **modified** version of this question paper – Figure 11 was erroneously referred to in question 01.2 (it should have been Figure 2). All students' scripts were reviewed and the error was found to have had no adverse impact on students' ability to answer the question as intended.

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

This Required Practical Activity is a familiar context on examination papers and most students were able to make some progress.

01.1 Often students gave solutions as opposed to the problems the errors would lead to. The start line being drawn in ink was the most common correct response, however, the problems encountered were often vague such as the experiment would not work. Nearly 95% of students gained at least 1 mark, with over 1 in 5 gaining all 4 marks.

01.2 Conclusions were often poorly expressed or incomplete. The conclusion needed to be in terms of what was in brown ink. Common incorrect responses referred to the amount of a colour being linked to where it is found on a chromatogram.

01.3 Just over 90% of students were able to identify that the green colour was insoluble in the solvent.

01.4 The calculation of the R_f value relied on the skill that students were able to rearrange the given equation which was successfully achieved by nearly 80% of students. Where an incorrect answer was obtained, no further credit was given when there was no working. Students should be encouraged to show their working in calculations so that appropriate credit can be awarded if a final answer is not given or is incorrect.

Question 2

The topic of water purification was generally not well known.

02.1 Over 50% of students were able to score at least 3 marks comparing the methods of treatment of ground and wastewater to make potable water. This was for simple statements that both waters need to be filtered and/or sterilised, and that ground water is easier to treat than wastewater. The idea that both waters need to be distilled was very commonly seen, mistaking this with sea water.

02.2 About 70% of students were able to identify distillation to desalinate sea water. The most common incorrect response was filtration.

02.3 Over half of students were able to score two marks on this item, with the conversion of cm^3 to dm^3 being the most likely mark missed. 1 in 5 students gained 3 marks here.

Question 3

The most accessible item in this question was the graph, however students found interpretation of the practical results difficult.

03.1 About 2 in 5 students scored at least 1 mark for this item. The most common answer was that sulfur dioxide or a gas was produced. There needed to be some recognition that sulfur dioxide was a product in the reaction, it was not enough to say that sulfur dioxide took part. Just over 15% of students then went on to say that the gas escaped from the flask.

03.2 Two thirds of students were able to identify time as the dependent variable.

03.3 Over 90% of students plotted the points correctly on the graph. Only 1 in 5 were able to then go onto drawing a curve of best fit whilst missing out the anomalous point.

03.4 About a third of students were able to correctly calculate the gradient and clearly show their working. Students should be encouraged to annotate the line that the gradient is calculated from, as marks cannot be awarded for numbers whose provenenance cannot be determined. Very few students were able to correctly determine the units.

03.5 About a quarter of students were able to score at least 1 mark on this question. This is an application of a standard explanation; however, many students still appear to think that concentration changes are related to the energy of the particles.

Question 4

There is only a small section on organic chemistry in this specification. However in responses students do not appear to have consolidated the ideas of organic chemistry.

04.1 Just over half of the students were able to identify butane from the picture.

04.2 There were only 2 in 5 students who were able to correctly quote this definition.

04.3 Students found balancing the cracking equation quite challenging, often making up molecules that fitted rather than working out possible molecules from prior knowledge.

04.4 It was anticipated that students would choose one of their products or identify one as an alkane or an alkene and quote a use. This was very rare, and students were given some leeway in identifying a use. Explanations as to why the molecule was used were even rarer.

04.5 Students found the start of this question very accessible, comparing the data supplied. Direct comparisons only allowed access to level 1, however, and links to the problems caused were required to make further progress. Nearly 10% of students were able to reach level 3. A judgement (which many students gave) and comparisons of both economic and environmental factors was required to do this. On evaluate questions, students need to bring in some of their own knowledge to access the higher levels.

Question 5

Students were able to demonstrate knowledge of the changes to the Earth's atmosphere, but knowledge of some of the other areas of the specification assessed in this question were a lot less familiar to students.

05.1 Over 90% of students achieved at least 1 mark on this question. This was predominantly for identifying that the concentration of oxygen increased. This was linked to photosynthesis as the next most common mark, followed by an increase

in nitrogen. The source of nitrogen from volcanoes was known by about 10% of students.

05.2 The formation of coal was not well known by students. About a quarter of students gained at least one mark, usually for knowing the timescale was over millions of years. 2 or more marks were achieved by fewer than 10% of students. The question asked how carbon dioxide was turned into coal. The most common misconceptions were around the idea that carbon dioxide is compressed.

05.3 Fewer than 2% of students gained the mark here. A comparison of the **proportion** of carbon in each fuel source was required for the mark. The most common responses were around the idea that coal was made from carbon dioxide, so released more back into the atmosphere.

05.4 Just over one third of students achieved at least one mark, usually for identifying bacteria. The least likely mark to be awarded was for the production of a solution containing copper compounds.

05.5 This was a high demand question where just over half of students scored at least one mark, often for a conversion from kg to g. Beyond that, students did not appear to be confident in interpreting the data given and only around 5% scored full marks.

Question 6

Students struggled to identitify which parts of this question were about rates and which were about equilibria.

06.1 Students found this recall question fairly straightforward with around 85% recognising that a biological catalyst was an enzyme.

06.2 About half of students could describe that catalysts lower the activation energy, however, fewer than 20% could link that to an alternative reaction pathway. There were lots of references to energy and frequency of collisions, but the responses lacked context.

06.3 Only 5% of students were able to make the link between conditions changing and the way that the equilibrium moves accordingly.

06.4 About a third of students gained at least one mark for this item. The closed system and equal rates in the forward and reverse directions were both seen, however, fewer than 10% of students mentioned both conditions.

06.5 Just under a third of students identified the increase in yield, which scored one mark. An explanation in terms of number of moles on each side of the equation was seen on very few occasions.

06.6 Many students answered this question in terms of rates of reaction, and gave an increase in yield because ammonia is made quicker, which did not score.
An explanation in terms of movement in the endothermic direction was seen on very few occasions.

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.