Grade 8 guarantees

Premium video tutorials exam-style questions and revision resources for the **9-1 Science GCSEs**

GCSE Chemistry

Summary of Examiners Reports

The large amount of content in the 9-1 Science GCSEs was already a challenging experience for both students and teachers, even before the pandemic caused widespread disruption to education. This year's GCSE Science exams will be the first since 2019 where the full content set will be assessed.

Ofqual is managing a return to normal this summer. It has confirmed that there will be no advance information for GCSE students and expects that GCSE results this summer will be much closer to the pre-pandemic years than those since 2020. Grade boundaries are expected to move back towards levels last seen in 2019. The links below provide tables of grade boundaries that year:

- Grade Boundaries – Combined Science
- Grade Boundaries – Separate Sciences

As this summer's GCSE Science exams will be the first since 2019 where the full content set will be assessed, examiners' reports from that time will be especially useful as a diagnostic tool to help teachers provide targeted guidance to students.

This blog provides a summary of the examiners' reports for both the 2018 and 2019 **Chemistry** papers. Next to each point, we highlight the relevant year. It covers both combined science and the separate sciences, foundation tier and higher tier. We have used the examiner reports prepared for the AQA exam board, but the same lessons apply to students taking Edexcel and OCR exams.

Overview

In Chemistry, several topics that were new to the 9-1 specification presented significant problems: this was the case in 2018 and then again in 2019. Many students confidently answered questions on topics which had been part of preceding specifications for many years (e.g. equilibrium and qualitative analysis) but topics which were new to the 9-1 specification were more problematic, including formulations, composites and condensation polymers. [2019]

Also, the new requirement for students to calculate instantaneous rates of reaction from graph tangents has led to confusion between this and the use of graphs to calculate mean rate of reaction over a specified time interval. [2019]

We've split the examiners' comments into three categories: 'Key exam skills', 'Graph skills', and 'Subject areas for development'.

Key exam skills

Key exam skills were lacking and accounted for a large share of lost marks, according to the examiners. A lack of exposure to basic terminology made it difficult for some students to access questions. There were some common misinterpretations due to lack of familiarity with common scientific terms such as 'electronic structure', 'formula' and 'molten' or 'liquid'. [2019] There was confusion regarding the difference between a liquid and a solution. [2018]

The examiners commented regularly on errors that could have been addressed by improving students' exam technique.

Specifically:

- A large number of students did not follow instructions which required them to tick one box only. [2019]
- A few students used up a lot of space by repeating the question, which uses up valuable time and does not gain any credit. [2019]
- Students often repeated the stem of the question in their answers, rather than either adding value to what they had been given or using their own knowledge to answer the question. This resulted in the loss of a lot of marks for many students. [2018]
- Students often used pronouns such as 'it' and 'they' in their answers to questions. This wasn't specific enough for the mark scheme and students lost marks as result. [2018, 2019]
- Students should know that state symbols are lower case only and are written in brackets. [2019]

- Students would benefit from use of more specific terminology. For example, students rarely used the term ‘giant lattice structure’ to describe the structure of potassium chloride and this cost them marks. [2018] Students need to distinguish between ‘bromide’ and ‘bromine’. [2018] ‘Amount of acid’ was often used instead of ‘volume of acid’. [2019]

- In questions regarding practicals and in other questions requiring extended writing, some students provided detailed additional information that did not contribute to a fully answered question and therefore did not gain any credit. [2019]

- Where asked to ‘*explain’* in questions, students often *described* instead. This limited the number of marks they were able to achieve. [2018, 2019]

- In ‘*evaluate’* questions, which were usually extended response, students often used only the knowledge given in the question, without bringing in any of their own. A judgment is an essential part of the answer, where the command word is ‘evaluate’. [2018] When asked to ‘*evaluate’*, many students gave a comparison using the figures in a table but did not go on to offer a judgment. [2019]

- The correct test and result for oxygen gas (reignition of a glowing splint) was known by only 54% of students. Using a splint (not glowing) or a ‘blown-out splint’ to test for oxygen were the most frequently seen incorrect answers. [2019]

- The idea of a formulation is still not well understood. ‘Formula’ and ‘formulate’ are not synonyms and gain no credit. Most students did not know the specifications’ definition of a formulation. Often students said it was ‘a mixture’ or ‘chemicals mixed together’ but omitted the idea of ‘to form a useful product’. [2019]

- Students would benefit from practising unit conversions, such as cm^3 to dm^3 or kg to g for mole calculations. [2018]

- Students must ensure they round answers at the end of a calculation, not at each stage. These maths skills errors caused many students to lose marks. [2018] Calculation answers should always be given in decimals, never fractions, even if fractions are the default answers on the student’s calculator. [2018, 2019] Many students were confused by standard form. [2019]

- As ever, students would have gained more marks if they had shown their working out in calculations where they did not arrive at the correct answer. This is particularly important in unstructured calculation questions, in which partial marks are often awarded for clear working. Examiners also reported that students’ working was often difficult to follow. [2018, 2019]

Graph skills

- Students had particular difficulty with describing trends in curved graphs. The idea of a gas being collected at an increasing rate (which could be expressed as “faster and faster”) was very rarely seen. [2018]

- While most students were able to correctly draw a line of best fit, many didn’t plot the point at the origin (0,0). Others were not aware that a line of best fit can be a curve. [2018]

- Examiners noted that students would benefit from practising how to describe graphs by breaking them down into different stages, such as “for the first 10 seconds” and “between 10 and 30 seconds”, etc. Students lost marks by failing to do this. [2018]

- Common graph errors included: failing to plot the point at the origin, incorrectly plotting the points, drawing a straight line of best fit rather than a curved line of best fit. [2019]

- Points plotted as ‘crosses’ are easier to see and mark than those points plotted as ‘dots’. [2019]

- Large, heavy crosses can make it difficult to determine whether the plotted points are within tolerance. Students who do this risk losing marks. [2019]

The errors above can be addressed by using My GCSE Science to help improve students’ exam technique. My GCSE Science long-form exam-style questions and corresponding mark schemes help students build an in-depth understanding of each topic while at the same time developing exam technique.

Our teachers have also prepared blogs that deal directly with exam skills, maths skills and graph skills. These blogs cover all of the issues raised by the examiners and are available free on www.my-GCSEscience.com.

- Blog: Command words in GCSE Chemistry
- Blog: Decimal places and significant figures
- Blog: Describing, explaining and comparing graphs

Subject areas for development

Below we outline specific topics in the curriculum which examiners identified as requiring further development.

- As noted above, examiners remarked that students particularly struggled with *new* topics on the specification, such as formulations, potable water and life cycle assessments [2018] and composites, condensation polymers and rates of reaction. [2019] These topics are covered comprehensively in the videos below:
    - Purity and formulations
    - Potable water
    - Life Cycle Assessment
    - Condensation polymerisation

- Students had difficulty writing balanced equations where they had to determine the formulae of the products. [2018] Balancing equations is a skill that is examined regularly but is still not performed well by some students. [2019]
    - Blog: Top tips for writing chemical formulae
    - Blog: Using brackets in chemical formulae
    - Blog: Balancing chemical equations

- Several questions tested students' understanding of how the structure and bonding of substances relates to properties such as electrical conductivity, melting point or boiling point. Only a very small proportion of students gained full marks in these questions. Examiners reported weakly expressed ideas, such as "graphite has three covalent bonds" and vague statements such as "it has weak intermolecular forces so little energy is needed to break the bonds". Mark schemes required precise scientific language, such as "each carbon atom makes three covalent bonds", "delocalised electrons carry charge through the structure" or "little energy is needed to break the weak intermolecular forces between molecules." [2018]

- Answers displayed confusion over the difference between chemical and physical properties. There was also a lot of confusion over types of bonding and forces, with students often contradicting themselves. Only higher-attaining students were able to explain that halogens have low boiling points because of weak intermolecular forces. It is these forces that are overcome when a 'little energy' is applied; 'less energy' did not gain this mark, as less does not necessarily equate to little. The concept of intermolecular forces and the fact that the intermolecular forces increase because the molecules got larger was rarely seen in explanations. [2019]

- In required practical questions that asked for a method description, students most often lost marks by failing to consider variables that needed to be controlled in order to ensure valid results. Credit was not given for expressing variables such as volume or mass simply as "amount". [2018]

- Students need practice in calculating a tangent (change in y / change in x). The majority of students were unable to correctly draw a tangent in order to determine the rate of reaction (gradient of the graph) at a given value. [2018] In calculating the rate of reaction, fewer than 10% of students gained all three marks. A large number of responses correctly identified that the rate of reaction decreased as time increased. However, correct answers relating to the rate at which the rate changed during the experiment were rarely seen. Many students did not know how to find a mean rate of reaction. [2019]
    - Interpreting rate graphs
    - Measuring rates of reaction

- Examiners reported that students clearly needed more practice in applying collision theory to explain the result of a reaction. That is, students must be aware that increasing the concentration increases the rate of reaction because there are more particles per unit volume, so there are more frequent collisions (or more collisions per second). Simply saying there were more particles was insufficient. Higher-attaining students were able to state that catalysts reduce the activation energy by providing an alternative route or pathway. [2018]
    - Collision theory and activation energy

- Students found the equilibrium section of the paper especially difficult. Most students struggled to explain why an equilibrium might be reached and how it can be affected. There was also confusion between rate and equilibrium. Many students did not know that rate is the speed of a reaction whereas equilibrium relates to how much of the product is produced (the yield of a reaction). The effects of temperature, pressure and catalysts on both the yield and rate in a reversible reaction were poorly understood in relation to explaining these effects using collision theory. [2018]
    - Factors affecting equilibrium

- The mark for describing the reaction that produces water in a hydrogen fuel cell was the least frequently scored. Many students gave incomplete responses indicating that hydrogen fuel cells produce steam (with no reference to water). Common misconceptions included that hydrogen fuel cells release hydrogen gas and that hydrogen burns in a hydrogen fuel cell. [2019]
    - Fuel cells

- The explanation for the use of cryolite in the extraction of aluminium does not appear to be well known. Almost two-thirds of students scored 0 marks. Students found the completion of the half-equation difficult. Almost 70% scored 0 marks. [2019]
    - Using electrolysis to extract metals

- Students found the titration calculation difficult. One third scored zero marks. [2019]
    - Titration

- Many students were not aware of the disadvantages of pollution from unburnt hydrocarbons nor were they able to correctly describe the reaction between nitrogen and oxygen to produce nitrogen oxides. [2018] Students still have the misconception that fuels need energy to burn, particularly those which do not ignite easily. Few students could state that the burning of wood is carbon neutral. [2019]
    - Atmospheric pollutants

- Student responses indicated that the mechanism by which greenhouse gases cause the greenhouse effect appears to be poorly understood. There was confusion as to which type of wavelength would pass through the atmosphere; 'reflected' or 'bounced off' were not accepted as alternatives to 'longer wavelengths being re-emitted'. [2019]
    - The greenhouse effect and global warming

- A large number of students did not explain how chromatography separates the dye. Instead they explained in detail how a chromatography experiment would be undertaken to separate the dyes. [2019]
    - Chromatography

- About 50% of students either did not know or could not recall the term 'thermosoftening'. [2019]
    - Using materials

- In organic chemistry, the drawing of displayed formulae was often problematic, such as the drawing of ethanol, or the polymer formed in addition polymerisation. [2018]
    - Addition polymerisation

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