



GCE A Level Examiners' Report

Chemistry
A Level
Summer 2024

Introduction

Our Principal examiners' report provides valuable feedback on the recent assessment series. It has been written by our Principal Examiners and Principal Moderators after the completion of marking and moderation, and details how candidates have performed in each component.

This report opens with a summary of candidates' performance, including the assessment objectives/skills/topics/themes being tested, and highlights the characteristics of successful performance and where performance could be improved. It then looks in detail at each unit, pinpointing aspects that proved challenging to some candidates and suggesting some reasons as to why that might be.¹

The information found in this report provides valuable insight for practitioners to support their teaching and learning activity. We would also encourage practitioners to share this document – in its entirety or in part – with their learners to help with exam preparation, to understand how to avoid pitfalls and to add to their revision toolbox.

Further support

Document	Description	Link
Professional Learning / CPD	Eduqas offers an extensive programme of online and face-to-face Professional Learning events. Access interactive feedback, review example candidate responses, gain practical ideas for the classroom and put questions to our dedicated team by registering for one of our events here.	https://www.eduqas.co.uk/home/professional-learning/
Past papers	Access the bank of past papers for this qualification, including the most recent assessments. Please note that we do not make past papers available on the public website until 12 months after the examination.	Portal by WJEC or on the Eduqas subject page
Grade boundary information	Grade boundaries are the minimum number of marks needed to achieve each grade. For linear specifications, a single grade is awarded for the subject, rather than for each component that contributes towards the overall grade. Grade boundaries are published on results day.	For unitised specifications click here: Results and Grade Boundaries and PRS (eduqas.co.uk)

¹ Please note that where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report.

Exam Results Analysis	Eduqas provides information to examination centres via the WJEC Portal. This is restricted to centre staff only. Access is granted to centre staff by the Examinations Officer at the centre.	Portal by WJEC
Classroom Resources	Access our extensive range of FREE classroom resources, including blended learning materials, exam walk-throughs and knowledge organisers to support teaching and learning.	https://resources.edugas.co.uk/
Bank of Professional Learning materials	Access our bank of Professional Learning materials from previous events from our secure website and additional pre-recorded materials available in the public domain.	Portal by WJEC or on the Eduqas subject page.
Become an examiner with WJEC.	We are always looking to recruit new examiners or moderators. These opportunities can provide you with valuable insight into the assessment process, enhance your skill set, increase your understanding of your subject and inform your teaching.	Become an Examiner Eduqas

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Executive Summary

There were only a small number of entries for this qualification, and they were mostly very able candidates as in previous years. They performed very well across all areas of the specification and achieved excellent results.

Recall of knowledge was very good and most showed good understanding of the key concepts required for A Level Chemistry. The best candidates showed the ability to apply these ideas in unfamiliar situations and to consider more than one key concept when tackling complex problems.

Mathematical skills were again very good with most candidates confidently using logarithmic and exponential functions correctly. Conversion of values to ensure the appropriate units are used in given expressions is an area where a good number of candidates lost some marks.

Questions linked to familiar practical work such as the specified practical tasks were usually well answered. Some candidates struggled a little when asked to apply their understanding of those tasks to new or unfamiliar contexts.

Once again, a very pleasing performance for which candidates should be congratulated.

Areas for improvement	Classroom resources	Brief description of resource
Conversion of units	Resource (eduqas.co.uk) Knowledge organisers Chemical calculations part 2 Chemical kinetics	Knowledge organisers give a high-level summary of key knowledge and skills required within each specification topic, including exemplar calculations in the case of these two presentations
	Question Bank by Eduqas	Question Bank is a searchable past paper resource where keywords can be searched to find questions on topics that require conversion of units e.g. use of $pV = nRT$ and the Arrhenius equation
Understanding of practical methods	Chemistry Experiments on Film (science.cymru)	Experiments on Film is a video resource designed to complement the hands-on practical work

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COMPONENT 1 – PHYSICAL AND INORGANIC CHEMISTRY

Overview of the Component

Performance in Component 1 was similar to that in previous exam seasons. Almost all questions were of a similar level of challenge having facility factors in the range 72-82%. Question 14 was the most difficult question with a facility factor of 56. Almost all candidates attempted all part questions suggesting that adequate time was available.

The paper tests a range of knowledge and skills in the areas of physical and inorganic chemistry. Candidates are required to recall, understand and explain many properties, reactions and observations in inorganic chemistry with the physical chemistry work often requiring more mathematical answers. Inorganic chemistry questions requiring recall or short explanations were generally well answered but where concepts had to be applied to unfamiliar situations or different concepts needed to be combined, the answers were more variable. Physical chemistry calculations were usually well done but questions where manipulation of units was required proved difficult for some.

The examination gives candidates the opportunity to show skills across the full range of assessment objectives, requiring them to recall and apply knowledge and skills, to analyse evidence and come to judgements. Most candidates were able to recall and apply complex concepts across a range of topics.

This paper requires candidates to use a wider range of mathematical skills than the other two papers. Most performed well on these questions, although having to change units occasionally proved challenging. All could apply basic mathematical conventions and most could also use more advanced ideas such as logarithms and exponentials.

Chemistry is a practical subject so this examination also asked candidates to outline appropriate practical techniques and plan efficient practical routes. They used experimental data to come to a conclusion. Questions that required recall or application of a familiar method were generally well answered. Weaker answers were common in questions based on unfamiliar experiments or contexts.

Comments on individual questions/sections

SECTION A

Most questions in Section A were answered well however weaker candidates failed to recall some basic points. Questions 4 and 6 required some application and they were the most difficult parts of this section.

Q4 Most candidates were able to suggest an appropriate method for measuring the reaction rate in part (a). Many gave clear answers referring to colorimetry or the use of a colorimeter but a minority gave vague answers referring to time taken for a colour change or time taken to go colourless.

When using the experimental data in part (b), candidates gave much more variable answers. It was common to see the order of reaction with respect to cyclohexene given as second order. Some candidates calculated the orders of reaction but then could not write an appropriate rate equation. Errors included omitting the rate constant or the square brackets, or giving an incorrect formula for cyclohexene.

Q6 Most candidates realised that the isotope pattern identified the presence of a single chlorine atom. Fewer could then identify the remaining atoms present in the formula with a range of atoms suggested. It was not uncommon to see formulae with atoms of more than two elements or inclusion of non-halogen atoms such as carbon and hydrogen.

SECTION B

Q9(a) A small number of candidates did not realise that sodium hydroxide is a strong base and attempted to use weak acid or strong acid calculation methods in part (i).

In part (ii) many candidates did not recognise that this was a buffer solution. Common errors were to treat it as a weak acid solution based either on the initial concentration of the propanoic acid or the concentration of the acid after partial neutralisation. Those candidates who realised that this was a buffer solution frequently used the initial concentrations of the acid and sodium hydroxide rather than the salt and acid concentrations after neutralisation. This gave a 2:1 ratio rather than the correct 1:1 ratio in their calculations.

In part (iii) most candidates could suggest improvements to the method, but they did not always explain their reasoning correctly or in sufficient detail. It was common to see candidates discussing heat being lost to the surroundings rather than being gained from the surroundings as would be the case for an endothermic reaction.

Q10(d) Most candidates identified the fact that three half-lives had passed in the time stated in the question. Many failed to read the question carefully and gave the mass of americium remaining rather than the mass of plutonium formed. A similar lack of focus was clear in part (ii) where many suggested reasons why it was important to know the half-life of the americium isotope rather than the plutonium formed.

Q11(a) Most were able to identify the order of reaction from the unit but those that did not do so often gave poor reasoning e.g. it is first order because there is only one reactant. The Arrhenius equation was used well by many candidates. Incorrect answers were often due to failing to J to kJ or using the temperature in °C.

In part (d) most candidates were able to give an outline method but many lost marks for lack of detail or clarity. Points such as the following suggested that candidates would not score a top band mark:

- stating that the solution is initially made in a volumetric flask
- stating that deionised water is added to the solid NaHCO_3 with no reference to a volume or that it must be enough to dissolve all the solid
- stating that equipment is washed but not that the washings are transferred to the volumetric flask
- stating that deionised water is added 'up to mark' rather than aiming to have the bottom of the meniscus on the graduation line

Q12 The calculations in parts (a), (b) and (c) were done well although some candidates halved the calculated moles of acid that had reacted with the mineral to reach the answer, rather than subtracting twice the moles of the mineral to account for the acid reacting with carbonate ions.

Candidates found combining the data to give the formula and oxidation state in parts (d) and (e) more challenging. Some were not able to use the relative molecular mass to find the formula or the charges to find the oxidation state of iron.

Q13(c) Most candidates wrote a correct expression for K_p but only a minority were able to correctly calculate the partial pressures involved. Many did not apply the stoichiometry of the reaction correctly whilst others did not convert the initial 1 atm pressure into Pa.

Q14(a) This QER question was most challenging part of the paper and the standard of responses was variable.

A few candidates did not read the question carefully enough and attempted to give methods of distinguishing between the compounds in each mixture rather than distinguishing between each of the mixtures. When deciding on tests, some candidates attempted a brute force method of giving observations for all mixtures with all possible tests. Although they could be identified in this way, describing the process would have taken much more time than detailing a more strategic approach where three or four tests done in a given order would solve the problem.

Many described tests that give a precipitate without realising that the mixtures are all solids and that it was therefore necessary to produce solutions. Stronger candidates stated that nitric acid was needed to dissolve some of the mixtures prior to the addition of sodium hydroxide or began by adding nitric acid with the solutions formed being used for all subsequent tests. Weaker candidates stated that sodium hydroxide was added to the mixture rather than a solution.

Other common errors included discussing reactions with acid without specifying which acid and giving the observations for some mixtures in a test without specifying the observations for mixtures that don't give a positive result. Weaker answers stated, for example, that 'acid is added to all six mixtures to form solutions and mixtures **D** and **E** give effervescence'. This does not clearly identify that the other mixtures did not give effervescence and without identifying the acid it is not possible to identify if all the mixtures give solutions or if some have an insoluble component.

The best answers used tests efficiently to obtain the maximum amount of information from each one, and typically began with the reaction of nitric acid with all six mixtures. Observing effervescence and the formation of a blue solution allows three mixtures to be identified immediately. Other tests were used to distinguish between the remaining three mixtures.

Q15(b) Most candidates were able to identify that the highest ionisation energy values were those of Li and Na and explain this in terms of the distance between the nucleus and the electron to be removed. The majority also included the idea of shielding in their explanation.

More candidates made errors in the ionisation energies of silicon and magnesium with the order of these two commonly reversed. The reasons for the incorrect assignment varied but included discussion of differing sub-shells or formation of filled or half-filled shells and sub-shells.

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COMPONENT 2 – ORGANIC CHEMISTRY AND ANALYSIS

Overview of the Component

The mean mark for this paper was significantly lower than last year's suggesting that it was more challenging. Given that it remains more than 70% of the available marks this is beneficial and resulted in a better spread of marks. Few candidates scored less than 70 marks out of 120.

As in previous years, those questions where candidates had to apply their knowledge to unfamiliar situations proved more difficult than those which were based more closely on details described directly in the specification.

All questions were answered well, including those featuring mathematical skills and practical content. There was no evidence of candidates being rushed to finish this long paper, which as always required a fair amount of reading.

Comments on individual questions/sections

SECTION A

- Q.2 The question gave the molecular formula as $C_3H_6O_2$ but a number of candidates, realising that the question was about aldehyde chemistry, gave a formula that contained only one oxygen atom. Candidates needed to state that aldehydes **reduce** Fehling's reagent to Cu_2O in order to gain the second mark. This was seldom seen.
- Q.4 Giving the name of the nitrile that produced the addition polymer proved difficult for many. Some did not include 'ene' as part of the name. In general, the naming of nitriles is a weak area for many candidates.
- Q.5 (a) Although many candidates correctly found that the relative molecular mass of the silver salt of the acid is 181, fewer then gave the correct mass for the parent carboxylic acid.
- (b) A number of candidates did not realise that it was the formula of the alcohol that was required.
- Q.6 This question focused on phenylalanine was very well answered.

SECTION B

- Q.7 (b) Candidates were required to use the Data Booklet to find the chemical shift of the $H-C=$ group. Many answers were given as 4.6 to 6.3 as candidates failed to realise that the ester has a carbonyl group next to the alkene. The expected answer was therefore 5.8 to 6.5.

- (d) (iii) In general, the chromatography question was done well and many candidates gave the correct value as 8.4 cm and showed this on the diagram.
- (e) (iii) I The question asked for the formula of the electrophile used in this electrophilic addition reaction. This was often answered poorly. A number of nucleophiles were suggested as well as hydrogen bromide itself.
- III Very few candidates stated that an excess of sodium hydroxide was required to ensure complete nucleophilic substitution and neutralisation of both acid groups.
- IV A number of candidates did not mention the electronegativity differences between carbon and bromine.
- Q.8 (a) (iii) I Many candidates did not realise that 2-bromoethylbenzene and 6-bromoethylbenzene are the same compound. In both I and II, side chain substitution was credited although this is probably unlikely to occur under these conditions.
- (d) (i) Many candidates gained at least one mark here, but fewer mentioned that the sodium benzoate formed was water soluble and that this enabled easier separation to take place.
- Q.9 (b) The question asked candidates to give the formula of the 2-butyl radical as part of the equation. Only a minority of candidates managed to do this.
- (d) Many candidates worked through parts (i)-(v) well and arrived at the correct structure of 2,3-dimethylpent-2-ene. Those who suggested an incorrect asymmetric alkene structure gained some credit if it had the molecular formula C_7H_{14} .
- (e) The question told candidates to ignore splitting due to the aldehyde group but some ignored this and gave some very confusing answers.
- Q.10 (a) This was the first of the two QER questions on the paper. It concerned the alkaline hydrolysis of methyl benzoate. Many sound responses were provided but some candidates assumed that two layers remained after reaction and that the use of a separating funnel was required. Methanol and sodium benzoate are both water soluble so this is unnecessary.
- (b) (iv) The question asked for the meaning of condensation *in this context*. In this reaction, hydrogen chloride is removed. No credit was given for reference to water being lost.
- (d) (ii) Many candidates coped well with this tricky calculation and gave the correct answer of 30.6 dm^3 .

- Q.11 (a) (i) The naming of the trihydric alcohol proved difficult for many candidates.
- (a) (v) I Many candidates gained both marks for this mechanism for nucleophilic addition. Please note that the curly arrow adjacent to the oxygen atom in the intermediate should go from a lone pair on the oxygen atom to the 'gap' between it and the H^+ ion and not directly to the H^+ ion.
- II The question asked why this reaction is described as nucleophilic addition. Although most candidates stated that the initial attack was by the nucleophile CN^- , very few then went on to describe why it was an *addition* reaction.
- (b) (ii) Many candidates failed to give the correct name of the dicarboxylic acid.
- (c) (ii) When decarboxylation is complete there would be no more effervescence on adding sodium hydrogencarbonate as phenol is not acidic enough to react with it. Many answers lacked sufficient detail to gain all three marks.
- Q.12 (a) This was the second of the QER questions. Some very good answers were seen where candidates used the information provided in a logical manner to deduce the structure of the diamide. Good use was made of the ^1H NMR data.
- (b) (i) The mechanism for the nitration of nitrobenzene was usually completed correctly but some candidates did not include the H^+ ion as the product.
- (iv) Not every candidate realised that Bismarck brown Y is a base. It has a number of $-\text{NH}_2$ groups and the nitrogen lone pair on each of these groups would act as a proton acceptor resulting in the formation of a salt.
- (c) Many candidates calculate the apparent M_r of ethanoic acid when dissolved in benzene but fewer correctly suggested the structure of the hydrogen bonded dimer.

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COMPONENT 3 – CHEMISTRY IN PRACTICE

Overview of the Component

This is a written paper testing learners' knowledge and understanding of the full range of practical methods encountered in the specification, with an additional emphasis on the analysis and evaluation of experimental data.

It proved successful in that it differentiated well. Some marks were accessible to almost all candidates whilst others were gained only by the most able. This led to a good distribution of marks with almost full marks being scored by the strongest candidates.

Performance on the calculations was excellent and answers were usually set out sufficiently clearly to be able to see what was being done at each stage. This allowed partial credit to be awarded when final answers were incorrect.

There was no indication that candidates had a problem with the length of the paper.

Comments on individual questions/sections

Q.1 Pleasingly, the vast majority of candidates gained at least 6 of the 8 marks for this question. They were able to identify and explain why titration number 2 had the smallest percentage error in the mass of $\text{Ca}(\text{IO}_3)_2 \cdot x\text{H}_2\text{O}$. However, the colour change of the starch indicator at the end-point was less well answered. Although the question asked for the colour *change*, some candidates simply answered 'colourless' or 'blue-black'. Another incorrect answer seen in a few scripts was 'colourless to brown-black'.

Almost all candidates correctly numbered the steps for the calculation in part (c). Consequently, only a small minority failed to get the correct value for x . Errors included

- calculating a mean titre rather than using the results from titration 2
- using an incorrect mole ratio of $\text{S}_2\text{O}_8^{2-} : \text{IO}_3^-$
- using an incorrect mole ratio of $\text{IO}_3^- : \text{Ca}(\text{IO}_3)_2 \cdot x\text{H}_2\text{O}$

Q.2 In part (a) of this question candidates were required to describe a method to collect data to study reaction order. It proved to be the most challenging question on the paper and a small number of candidates made no attempt.

The most common weaknesses included

- giving no description of how the concentration of $\text{S}_2\text{O}_8^{2-}$ would be halved
- failing to ensure that the total volume of solutions remains constant
- using measuring cylinders rather than volumetric pipettes or burettes to measure solutions

Surprisingly, in part (ii), only a minority of candidates gained the first mark for describing how the experiment should be modified with distilled water being replaced with the same volume of $\text{Fe}^{2+}(\text{aq})$ in order to investigate its catalytic effect.

- Q.3 In part (b) many candidates chose to distinguish between nitric acid and ethanoic acid by adding sodium carbonate (or sodium hydrogencarbonate). Surprisingly, a fair number did not gain the second mark because they incorrectly said that one of the acids would not react with the carbonate.

Many excellent answers were seen in part (c) with the majority of candidates scoring at least 2/4 marks. Errors included giving the inverse ratio of 1:4.47 rather than 4.47:1. When this was seen, the error was carried forward to prevent further penalty in part (ii).

- Q.4 In part (b) there were many good answers detailing a safe procedure to recrystallise the N-phenylethanamide. To gain full marks the answer had to include reference to dissolving the solid in the minimum volume of hot water and the correct sequence of steps was essential. Surprisingly, there were also many very poor answers with some candidates trying to distil off the water and others filtering off the recrystallised compound before the solution was cooled.

Part (d) was well answered with candidates showing good understanding of ^1H NMR and good knowledge of standard organic tests. The calculation in part (iv) was well done by the majority but as usual there were some issues in changing temperature and pressure values to the appropriate units for use in the ideal gas equation.

Part (v) was surprisingly poorly answered. Some candidates did not attempt this question and a significant number were unable to give the correct structures.

Common errors included

- carelessly drawing the aldehyde and methyl side groups in the incorrect positions on the ring
- placing the positive charge on the incorrect nitrogen atom in the diazonium ion
- connecting the phenol to the diazonium ion in the incorrect position
- drawing the azo group with a $\text{N}\equiv\text{N}$ triple bond

- Q.5 Many candidates gave excellent answers for this inorganic analysis question with a significant number scoring all of the available 12 marks.

Marks were most commonly lost for not balancing the equation for the reaction in Test 2A and failing to get the correct ratio of ions from the last two tests.

Supporting you

Useful contacts and links

Our friendly subject team is on hand to support you between 8.30am and 5.00pm, Monday to Friday.

Tel: 029 2240 4252

Email: science@edugas.co.uk

Qualification webpage: [AS and A Level Chemistry | Edugas](#)

See other useful contacts here: [Useful Contacts | Edugas](#)

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