GCSE Examiners' Report

Chemistry

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 unit.

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	WJEC 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.wjec.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 WJEC subject page
Grade boundary information	Grade boundaries are the minimum number of marks needed to achieve each grade. For unitised specifications grade boundaries are expressed on a Uniform Mark Scale (UMS). UMS grade boundaries remain the same every year as the range of UMS mark percentages allocated to a particular grade does not change. UMS grade boundaries are published at overall subject and unit level. For linear specifications, a single grade is awarded for the subject, rather than for each unit that contributes towards the overall grade. Grade boundaries are published on results day.	For unitised specifications click here: Results, Grade Boundaries and PRS (wjec.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	WJEC 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.wjec.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 WJEC 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 | WJEC

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Executive Summary

Around 8700 candidates cashed-in GCSE Chemistry with a ratio of around 5:1 in favour of higher tier entries. A small number of higher tier candidates should have been entered for the foundation tier paper.

The inclusion of more objective style questions over recent papers has given candidates a better experience and led to higher mean marks and a better mark distribution. This general pattern continued and very few questions across all papers were not attempted. Mean marks on the Unit 2 papers were significantly higher than previously seen.

Lack of exam experience was evident for many Unit 1 candidates in particular. Lots of information which can be used in an answer is given in the question but many candidates did not read carefully enough to realise this. Similarly, they did not read and follow instructions e.g. on how many boxes to tick.

Recall of knowledge (AO1) continues to be an issue for many candidates. This includes simply not having learnt key facts, e.g. tests for ions, and giving answers lacking detail in longer responses, e.g. in QER questions.

Mathematical skills were generally good but the inability to convert units and use standard form were common weaknesses. Many struggled to calculate a percentage, but many others had no difficulty rearranging expressions for solution calculations. Rounding errors were commonly seen. Candidates should be encouraged to show their working in all calculations.

Some candidates struggled to express their ideas clearly, with incorrect terminology and vague language often seen. This was often exacerbated by poor spelling and punctuation, along with poor handwriting. Examiners cannot credit work which is illegible. Many noted difficulty in distinguishing between some numbers in numerous candidates' work. Carelessness in writing chemical symbols and formulae also resulted in many lost marks.

Most need further practise in writing chemical formulae and balancing equations but there was some evidence of improvement in these areas. Regular work on these skills should be built into teaching of the year 11 content. Centres are also reminded that calculations and chemical tests specified in the year 10 unit are also assessed in the year 11 paper so should be revisited when the opportunity arises.

Performance in the practical unit was good but questions based on practical work in the written papers often suggested a lack of first-hand experience of the relevant apparatus and methods.

Areas for improvement	Classroom resources	Brief description of resource
Recall of knowledge	Resource WJEC Educational Resources Website	Knowledge organisers include key facts for all specification topics summarised in one/two page presentations
Testing for ions	ATOMIC STRUCTURE AND THE PERIODIC TABLE	This blended learning resource is a good refresher for all content relating to atoms, electronic structure and the Periodic Table. It includes a section on testing for ions
Exam technique	Resource WJEC Educational Resources Website	Exam walk-through presentations on a full series of GCSE papers highlighting the skills needed to maximise performance

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Unit 1: Chemical Substances, Reactions and Essential Resources – Foundation Tier

Overview of the Unit

The paper style has changed slightly in recent years with more objective questions making it more accessible for candidates. This paper proved to be a little more demanding than last year's paper but less so than in 2022. The degree of difficulty of the questions increased throughout the paper, with questions in the common section providing the most challenge. The attempt rate for most questions was pleasing.

The foundation tier only section of the paper was generally well attempted with several multiple-choice questions that were accessible to all candidates. Despite this, many candidates lacked the basic knowledge and understanding required and therefore made random guesses. Questions that required descriptions and/or explanations were poorly answered, particularly when they required direct recall of knowledge. Where candidates did demonstrate some knowledge, many gave answers that lacked sufficient detail to gain credit.

Candidates continue to have difficulty in writing chemical formulae and balancing symbol equations. It is important that candidates learn how to use the formulae of common ions table correctly. These skills must be practised and developed throughout their study of Chemistry.

Questions that assessed candidates' knowledge of practical work were well attempted, when given as multiple choice. However, they found it difficult to show how a chromatogram is produced and to analyse the data collected.

Questions that assessed mathematical skills were generally well attempted. However, many candidates still lack the basic numeracy skills required to successfully access all marks, e.g. conversion of units and calculating a percentage.

The quality of graph work demonstrated by candidates was generally good and most were able to successfully plot points and draw a suitable line of best fit. Some lost marks for joining points with a ruler.

The PISA-style question was well attempted. Most candidates were able to use information from the article to answer the accompanying questions. Furthermore, because many of these questions were objective style, this made them more accessible to candidates.

The QER question was attempted by the vast majority but the standard of responses was disappointing with very few candidates awarded a top band mark.

Comments on individual questions/sections

Q.2 (a) (iii) Although the ions were given, almost half of candidates circled an incorrect formula, mostly $Li(OH)_2$.

(b) (i) Only a minority of candidates ticked the correct equation, reflecting the difficulty candidates have in this area.

(ii) Few candidates attained both correct observations for the flame test and silver nitrate test on lithium chloride. More gave the white precipitate than the red flame.

Q.3 (b) (i) Only a minority of candidates gave the correct formula for calcium oxide. Common incorrect answers included CaCO / Ca_2O_2 / Ca / Ca_2O.

(c) Many candidates were awarded one mark, mainly for reference to employment opportunities or for giving uses for limestone.

Q.4 (a) Very few candidates were able to give the correct mass and charge for the particles. Many gave 2 or 0 for the mass of a proton and 0 or 1 for the charge of an electron.

(b) Very few gained full credit by relating the meaning of atomic number and mass number to the numbers of particles. Many got one mark for the atomic number or group number.

Q.5 (b) Most candidates were able to identify **B** as the compound, although the reasoning for their choice lacked clarity. Many described two atoms being joined together with no reference to them being different types of atoms.

Q.6 (d) Most candidates recognised that the mass decreased over time. However, very few identified the large decrease between 1990 and 1995 and the small decrease during each interval since 1995.

Q.7 (b) Barely any candidates were able to provide an alternative method for softening hard water, other than boiling. Incorrect responses included filtration, adding soap and fluoridation.

(d) Only about one in four candidates gave a benefit for hard water. Those who did not gain credit made reference to reducing tooth decay, better taste and to hard water being cleaner and having less bacteria.

Q.8 (a) (i) The graph has the simplest possible scale and plotting by foundation tier candidates was very good. Those who lost marks usually did so because they joined each point to the next using a ruler. A smooth curve is the suitable line in this case.

(ii) Few candidates successfully converted the time from minutes into seconds. In the vast majority of cases this was because they did not read the question carefully enough. There are three prompts in the question drawing attention to the need to do this. Those who divided the correct volume by 1 were awarded one mark.

(b) Many candidates gained credit for stating that increasing the temperature increases the rate. Far fewer referred to increasing the concentration of the acid or reducing the particle size of the magnesium. References to changing the volume of acid or the mass of magnesium were not credited.

(c) Around one in four candidates did not attempt this question. Many of those who did attempt the calculation showed little understanding of the concept of yield by using the figure 0.5g in their working.

Q.9 The attempt rate for this QER question was reasonably good but the standard of responses was poor with a mean of 1.6 out of 6 marks. Few candidates used their knowledge to discuss the statements made by the students. As in previous years, the standard of handwriting, spelling and grammar was often poor.

Many candidates recognised that fluoride, in large quantities, can be poisonous and that fluoride is present in toothpaste/mouthwash. This was sufficient to gain a lower band mark.

Middle band responses included the above as well as reference to fluorosis/teeth turning yellow however they did not refer to the relevant student's statement. Very few referred to water fluoridation as a form of mass medication. Barely any responses were awarded a top band mark.

Many incorrectly stated that fluoride whitens teeth and references to hard water and chlorination were common.

Q.10 (a) (ii) Some correctly identified **D** & **F** as gases at room temperature, however they barely ever managed to use the appropriate language to explain their choice. No credit was given for stating that their boiling points are low or that they are negative values. There must be a direct comparison between room temperature and the boiling point.

(iii) Very poorly answered with most candidates unable to identify **C** as the metalloid. The majority who did identify the metalloid did not state that it has both metal and non-metal properties.

(b) Very few candidates gave the correct formula for aluminium oxide. That being the case they were not able to access the balancing mark.

Q.11 (a) About half did not attempt this question and again this can only really be explained by candidates not reading the introduction carefully. Of those who did answer, most gained one of the two marks. Many drew the water level above the ink sample.

(b) (i) Barely any foundation tier candidates stated that the dyes have different solubilities or that they move at different speeds.

Q.12 (a) Barely any candidates referred to convection currents and fewer still mentioned the Earth's mantle as needed to gain the mark. This is a good example of weakness in straight recall of facts.

(b) Candidates made a better job of describing what happens at a constructive boundary than at a destructive boundary. Many gained a mark for magma escaping. For the destructive boundary, candidates did not refer to the relative densities of the different plates.

(c) Most candidates attempted the calculation, although few correctly converted the units e.g. by changing distance in km to a value in mm.

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Unit 1: Chemical Substances, Reactions and Essential Resources – Higher Tier

Overview of the Unit

The demand of the paper was comparable to that in previous series and it was a suitable and fair test for candidates at higher tier level. The degree of difficulty increased throughout the paper, with the most challenging questions towards the end.

Almost all part-questions were attempted by the vast majority of candidates, including those towards the end of the paper. This is an improvement on previous years.

Performance on questions where candidates required descriptions and/or explanations in their responses was poor. Where candidates did demonstrate some knowledge and understanding, many gave answers that were either too vague or that did not specifically relate to the question.

Candidates continue to have difficulty in writing chemical formulae and balancing symbol equations. It is important that candidates learn how to use the formulae of common ions table correctly. These skills must be practised and developed throughout their study of Chemistry.

Questions based around practical work were better answered than in the foundation tier paper.

Questions that assessed basic mathematical skills were generally well answered. However, some candidates struggled with the conversion of units and standard form.

The quality of graph work was very good and almost all candidates at this level were able to draw a smooth curve through the points plotted.

As in previous years, the PISA-style question was well answered. Most candidates were able to use information from the article to answer the accompanying questions. Furthermore, because many of these questions were objective style, this made them more accessible to all candidates.

The QER question was attempted by almost all candidates but the mean mark suggests that the majority scored a bottom band mark. This style of question is difficult even for higher tier candidates and the displacement reactions of halogens is one of the most challenging topics in the specification so this is understandable.

Comments on individual questions/sections

Q.1 (a) (iii) Poorly answered with many candidates unable to identify **C** as the metalloid. The most common incorrect answer was **G**. The majority who correctly identified the metalloid were also able to explain that it has both metal and non-metal properties.

(b) This was reasonably well answered with a mean mark of almost 1 out of 2. The formula for aluminium oxide must be correct to access the second mark.

Q.2 (a) About a quarter did not attempt this question and this can only really be explained by candidates not reading the introduction carefully. Of those who did answer, most gained both marks.

Q.3 (a) This was answered poorly by higher tier candidates too. It is a simple question but requires the recall of specific terminology which proved beyond the majority.

Q.4 (a) (i)&(ii) Most candidates gave the correct answer in both questions. Credit was lost when candidates made any reference to neutrons.

(ii) Most gained this mark, although few mixed up the group and period numbers.

Q.5 (c) The majority of candidates correctly sketched a curve of the shape that would be seen at a higher temperature. The mark was lost in cases where more than 70 cm^3 of gas was produced.

(e) Only one in three candidates stated that a catalyst lowers the activation energy of a reaction.

Q.6 (b) Most candidates knew the name of the alkaline compound formed but only a minority gave the correct chemical formula.

(c) The mean mark for this question was 1.5 out of 3. The most commonly awarded mark was for giving the formula of oxygen gas. Both formulae had to be correct before the final mark for balancing could be awarded.

Q.7 (a) (iv) Complete answers were not common here. A good number referred to the atomic radius being too small but few linked this to the strength of the attraction between the outer electron and the nucleus.

(b) Most candidates gave a suitable use for helium, mostly in balloons. However, fewer linked the use to a property. Hot air balloon was the most common incorrect use.

Q.8 The QER question was attempted by 90% of candidates. This was a difficult question and only the strongest candidates answered well. Many described reacting the halogens with sodium or iron to establish an order of reactivity but that gained no credit. Some referred to the reactions of the halides with silver nitrate.

Some made good attempts at describing observations for the displacement reactions and credit was awarded for suitable word equations. Higher-level credit was given for symbol equations but the usual errors, i.e. single halogen atoms and incorrect halide formulae, were commonly seen.

Q.9 (a) Most questions on the reactions of limestone require simple recall and these were fairly well answered, with the exception of the observation made when water is added to calcium oxide.

(b) Only one in five candidates gained credit for this AO3 question which required some kind of comparison of the relative stabilities of sodium carbonate and calcium carbonate. Credit was awarded for stating that the Bunsen burner flame was not hot enough to decompose sodium carbonate.

Q.10 (a) (i) Many candidates identified the correct type of water hardness for **A**, although the reasoning was often too vague to get the second mark, e.g. volume decreases after boiling gets no credit because this statement is also true for sample **D**.

(a) (ii) Many candidates identified **D** as the correct water sample. As above, their reasoning often lacked the detail needed to get the second mark.

(b) This was poorly answered. Most candidates did not make a comparison between the two tables of results. Many stated the type of hardness based on the second table but made no reference to which conclusions are similar from both data sets and which are different.

(c) Most had some idea of how ion exchange works but many lost marks for not referring to sodium ions or for not using 'ions' anywhere in their answer. Reference to ions being 'displaced' was not credited.

(d) (i) This was well done with nearly all candidates able to substitute correctly and find the correct value. Those who lost marks usually failed to give their answer in standard form.

(ii) Many candidates stated that the sample containing magnesium sulfate was harder due to its higher M_r. The majority who attained credit calculated the number of moles of magnesium chloride as part of their reasoning. Some lost credit for incorrect rounding.

Q.11 (a) (i) The mean mark here was very close to one out of three and this reflects the fact that most could correctly give FeBr3 as the formula of the product but not Br2 for elemental bromine. As is usually the case, no balancing mark was awarded unless all formula were correct.

(ii) Only a minority of candidates gained all three marks here. Most candidates included some correct detail in their answer but there was often missing information and terminology. Marks were lost for describing a 'precipitate test' with no reference to silver nitrate and some gave the correct colours without stating that a precipitate formed. Tests for ions are simple recall and all higher tier candidates should be familiar with them. They will also be assessed in the year 11 paper so it should be well worth ensuring that candidates have hands-on experience of using them.

(b) Questions on simplest formula appear regularly and this was well answered. Where candidates understood the method needed to answer the question, the most common errors were dividing the numbers the wrong way around in the first step, not expressing a simplest whole number ratio and not using the ratio to give the formula of the compound.

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Unit 2: Chemical Bonding, Application of Chemical Reactions and Organic Chemistry – Foundation Tier

Overview of the Unit

The paper proved to be of an appropriate level of demand with a pleasing mean mark of 43.9. This is significantly higher than last year's mean but similar to that in 2022. Almost all questions were attempted by the vast majority of candidates.

Candidates coped well with the foundation only section of the paper which includes many multiple-choice type questions. Performance on the common section was as expected with the exception of one or two part-questions which were poorly answered. In general, AO2 (application) and AO3 (interpretation) questions were better answered than AO1(recall) questions.

There was an improvement in basic numeracy skills (addition, subtraction and multiplication). However, many candidates struggled to convert units, e.g. to change millilitres to litres. It was noticeable that many candidates wrote their numbers in a way that made them easily mistaken for others, e.g. with the number '4' often looking like a '7' or a '9'.

In questions which required a sentence of more of writing, marks were often lost due to poor expression. Candidates should be encouraged to spend a minute or two planning what is to be included in the answer for the QER question. Handwriting was often poor, and in some cases illegible. Carelessness in this area lead directly to marks being lost when writing chemical symbols and formulae, where differentiating between upper case and lower case letters is essential. In some cases, candidates did not refer to the ion table given at the back of the paper and used completely incorrect formulae for certain ions.

Candidates who had broad experience of practical work performed better on questions 1, 4, 5(c), 9 and 10 than those who did not.

Comments on individual questions/sections

Q.1 (a) Those candidates who had little experience of practical work were at a disadvantage when answering this question. Many gave the letter **A** for the first stage of the experiment, i.e. the first diagram in the sequence, although they were told the stages were not in the correct order. Many candidates did not know that hydrogen is formed when a metal reacts with an acid. Disappointingly, a significant number of candidates could not identify the formula for magnesium chloride, given the two ions in the compound.

(b) Most candidates were able to identify the acid and the salt formed in the two reactions.

Q.2 (a) (i) Candidates demonstrated a good knowledge of the extraction of aluminium. However, many did not know the meaning of the term 'molten'. The most common misconception was that aluminium was removed from the cell as a solid.

(ii) Most foundation tier candidates struggle with balancing equations and only one in three gave the correct answer. The most common incorrect answer was '2'.

(b) Most candidates gained both marks. The most common incorrect answers were 'shiny' and 'good thermal conductor'.

Q.3 (a) (i) Only half the candidates gained this mark. Many gave the reverse order.

(ii) Most candidates gained credit for 'Cu' but some lost the second mark by giving an incorrect formula for zinc oxide, e.g. Zn_2O_2 , Zn_2O.

(b) (i) The question stem states that a *solid* precipitate is formed, however most candidates gave silver chloride the (aq) state symbol. They clearly did not read the question carefully enough.

(ii) Answers here appeared to be randomly chosen by candidates. Many clearly had little understanding of the reaction happening and likely had little hands-on experience of using this test.

Q.4 (a) (i) Graph plotting was as usual good, but the curve required here was unusual and often not drawn correctly. The most common errors were joining points with a ruler and attempting to draw a straight line of best fit.

(ii) I Half of all candidates failed to get this mark with many not finding the lowest temperature from the graph. The commonest incorrect answers were 3.7°C and 17.3°C.

III Only one in four candidates gave the correct answer with the majority going straight for putting a lid on the cup without reading the question carefully.

(b) Surprisingly, many candidates could not calculate the relative formula mass for a straightforward example such as $NaHCO_3$. The most common error was not multiplying the mass of oxygen by three.

Q.5 (a) Candidates were able to answer this question well since most of the knowledge needed was provided. Many however stated that both processes use catalysts which are metallic elements i.e. not understanding that vanadium(V) oxide is a compound.

(b) This question on bond energies was well answered except for part (ii)I where only one in three gave the correct answer.

(c) As in previous years, knowledge of chemical tests was poor. This suggests lack of hands-on experience of using them. The mark for the carbonate ion was awarded more often than the sulfate ion.

Q.6 Many candidates lost marks in part (a) by not using the information in the diagram or the list of common ions at the back of the examination paper. This demonstrates poor examination technique.

(a) (i) More candidates gained the mark for the charge on the calcium ion than for the electronic structure of the oxide ion. The most common error was to give the same electronic structure as the calcium ion.

(ii) Fewer than half of candidates gave the correct formula for calcium oxide despite it following clearly from part (i). Without this formula the second mark could not be awarded. As stated each year, time spent practising skills in writing chemical formulae is time well spent.

(b) This simple covalent bonding diagram was not well done by all. The most common error was to show an additional electron in the hydrogen orbit. Most candidates gained both marks or none.

Q.7 Parts (a) and (b) were very well answered. Recognising the unsaturated compound in (b)(ii) was the most problematic area.

(c) (i) Half of candidates gained this mark and again poor exam technique was common. Many gave an answer other than a number as asked for e.g. filtration.

(iii) Most candidates multiplied three numbers to obtain an answer without converting millilitres to litres. They were awarded 1 mark. Of those who attempted to change millilitres to litres only a small number did so correctly. This is a common weakness.

Q.8 (a) This QER question was attempted by almost all because the content was well within the grasp of foundation tier candidates. However, as in previous years the standard of handwriting, spelling and grammar was often poor. There was very little evidence that candidates planned their answers. Some candidates ignored the photographs and applied the triangle to different situations. e.g. using a fire blanket to remove air.

Candidates were expected to use the fire triangle to *explain* how the different methods work. Most simply described how they worked without referring to the fire triangle.

(b) All parts of this PISA-style question were very well answered.

Q.9 (a) One in every three candidates failed to calculate the temperature rise and then identify the correct metal from the table.

(b) Most chose the correct conclusion and gained this mark.

(c) The most common mark was 1 out of 2 awarded for simply giving the symbol for nickel from the Periodic Table. Few foundation tier candidates gained the mark for the formula of iron(II) sulfate.

(d) Very few foundation tier candidates gained this mark which requires very specific recall. Common incorrect answers included ‘exothermic’ and ‘neutralisation’.

(e) Most managed the correct multiplication to gain 1 mark but many did not give the answer to the nearest 100 J as needed. This may again be due to them not having read the question carefully enough.

Q.10 (a) (i) It was surprising that barely any candidates could correctly give the test for oxygen gas. The most common error was failing to describe a glowing splint. Many referred to an 'unlit' or 'extinguished' splint and they did not get credit. It is very difficult to think of anything other than a glowing splint being acceptable.

(ii) More than half of candidates gained this mark.

(b) (i) Most gained 1 mark for the copper ion but many incorrectly included an OH^- ion with the bromide ion. Every effort was made in the question design to help candidates avoid this error and this again shows a degree of weakness in examination technique.

(ii) This question was poorly answered. Most candidates were unable to use the information in the table to name the substances.

Q.11 Recall was generally poor in all parts of this question.

(a) Only about one in three candidates recognised that both structures are made of carbon atoms.

(b) Fewer than half of candidates stated that both substances have covalent bonding.

(c) The mean mark on this part-question was 1.8 out of 4. Those who gained 1 mark usually did so by stating that graphite is soft. Surprisingly few candidates could give a use of graphite. Many incorrect uses given suggested confusion with nanomaterials and smart materials.

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Unit 2: Chemical Bonding, Application of Chemical Reactions and Organic Chemistry – Higher Tier

Overview of the Unit

This paper proved to be much less demanding than last year's and candidates found it very much to their liking. The mean mark of 53.3 is much higher than previously seen. The QER question and the solution calculations differentiated well. As in previous years there were a small number of candidates who would have benefitted from sitting the foundation tier paper.

In general, AO2 (application) and AO3 (interpretation) questions were better answered than AO1 (recall) questions. The relevant expressions were given for the solution calculations in question 9 whereas in previous years they were not. Despite needing to rearrange the expressions candidates answered very much better than in the past.

Mathematical work was generally good although candidates should be encouraged to logically and clearly show their method so that some marks can be awarded even when the final answer is not correct. Graph plotting was as always good but some had difficulty deciding what type of line was appropriate for the data in question 6(d). As noted for the foundation tier paper, many candidates wrote their numbers in a way that made them easily mistaken for others, e.g. with the number '4' often looking like a '7' or a '9'.

Clarity of communication is essential when explaining the more difficult ideas in chemistry and most candidates could improve in this area. It is particularly relevant in QER questions where taking a minute or two to plan the content of the answer would very helpful.

Writing chemical formula and equations are important skills in chemistry and numerous marks are awarded for these on all papers. Most candidates showed some positive achievement in this area but relatively few were wholly confident. Many candidates lost marks by not using the table of ions provided in the examination paper.

Performance on questions linked to practical work varied significantly suggesting that not all candidates had a broad experience of standard experiments.

Comments on individual questions/sections

Q.1 Higher tier candidates answered this question very well with a small number failing to get the recall mark in part (d) and not giving their answer to the nearest 100 J in part (e).

Q.2 (a) (i) Even higher tier candidates struggled to get this mark with the same incorrect descriptions of a glowing splint seen. Some gave the test for hydrogen, carbon dioxide or even ammonia.

(b) (i) Most candidates gained both marks. Weaker candidates stated that there are OH^- ions as well as Br^- ions present in molten lead(II) bromide.

(ii) This was well answered with a mean mark of almost 2 out of 3. The most common error was to name gas **B** as 'chloride'.

Q.3 Parts (a) and (b) were well answered.

(c) Most candidates gained two marks for stating that graphite is soft and that it is therefore used in pencils. Most identified that it conducts electricity but few gave a sufficiently specific use to gain the last mark. Vague reference to graphite being used in mobile phones or in electrolysis was not credited.

Q.4 This bonding question included a good amount of scaffolding and was generally well answered. Marks were mostly lost through careless errors or omissions.

(a) (i) Some lost a mark for not including the octet in the second shell of the sodium ions. Others gave the oxide ion a 1– charge or omitted the charge on the sodium ions.

(ii) The information given clearly shows that sodium oxide contains two sodium ions and one oxide ion but a significant number of candidates still gave the formula of sodium oxide as NaO_2. These candidates lost both marks available for the equation.

(b) Both parts on covalent bonding were very well answered.

Question 5

(a) (i) The mean mark was a pleasing 2 out of 3. There is evidence that higher tier candidates have improved their skills in writing formulae and equations in recent years. Many gained all 3 marks. The most common error was not including diatomic hydrogen in equation **A**.

(ii) Generally well answered.

(b) (i) Most candidates were able to recall the term neutralisation.

(ii) I Weaker candidates incorrectly read the scale on the pH axis and gave a value of 12.2 rather than 12.4.

II When some candidates see the word 'completely' in a graph question they immediately give the value at the end of the line. Only a minority of candidates really understood what this graph shows.

III Many candidates appeared to struggle with this question and all four statements were commonly suggested.

(b) (iii) A wide range of answers were acceptable here and the vast majority were awarded the mark.

Q.6 (b) The question noted in bold print that the catalyst is a compound in order to steer candidates away from giving the catalyst for the Haber process. Many still gave iron and only one in three gave the correct answer.

(c) This question requires detailed recall and was not surprisingly poorly answered. Some focussed on general laboratory safety rules and some seemed to be describing the reaction of alkali metals with water.

(d) This graph requires interaction with a slightly unusual scale but points were plotted very well. On the other hand, some candidates attempted to draw a straight line of best fit when the points lie on an obvious curve.

(f) Most candidates read correctly from the graph to gain this mark.

Q.7 (a) (i) A few candidates did not understand the question and simply gave other examples of alkenes, e.g. C_5H_{10}.

(ii) Parts I and II were well answered with the usual errors. Part III is another recall question that was very poorly answered.

(iii) A mean mark of 1.7 out of 2 suggests that this correctly answered by the majority.

(b) (i) This question was extremely well answered and the vast majority gained both marks.

(ii) Weaker candidates calculated the energy released when forming six C—H bonds but did not complete the subtraction to get the correct answer.

(iii) Another recall question that was poorly answered with fewer than half of candidates selecting the correct profile.

(c) As usual most candidates matched the names to the structures. Some mixed up but-1-ene and but-2-ene.

Q.8 (a) Candidates performed well in this PISA-style question. Part (iii) was often misunderstood by weaker candidates who simply described the meaning of the term ‘carbon neutral’.

(b) (i) Most candidates were able to draw the structure of ethanol.

(ii) Very few candidates could name magnesium ethanoate but almost two out of every three identified its formula.

(c) Candidates generally struggle with chemical analysis but this multiple-choice question was reasonably well answered. Most identified **A** as ammonium carbonate and **C** as copper(II) chloride. Compound **B** was often incorrectly identified as iron(II) chloride rather than iron(II) sulfate.

Q.9 (a) A lot of information was given in the stem of this QER question to reduce the need for simple recall. Candidates had to use this information to explain the formation of aluminium and oxygen. Electrode equations were also expected. It was intended that this question should differentiate and that proved to be the case.

Weaker candidates generally repeated information from the stem and referred to ions moving towards electrodes of opposite charge whilst those at the top end explained the process confidently using ions, atoms and molecules correctly, referring to reduction and oxidation and writing good electrode equations.

(b) Poorly answered. The question clearly stated that there should be no reference to workforce or transport infrastructure, but many candidates failed to read this instruction.

The two parts of the answer were linked, i.e. a correct factor had to be given before the explanation mark could be awarded. Only those who could express themselves clearly gained both marks.

Q.10 Formulae were provided in both parts (a) and (b) and this proved to be very helpful for candidates even though they needed to be rearranged. Both parts were very well answered with weaker candidates dropping a mark or two for incorrect rearrangement, failing to convert cm^3 to dm^3 or for making an error in calculating M_r for citric acid.

CHEMISTRY

GCSE

Summer 2024

UNIT 3 – PRACTICAL ASSESSMENT

Overview of the Unit

In this unit candidates are assessed on their practical skills, including forming hypotheses, recognising and preventing hazards and risks, recording and presenting data, understanding the variables that are involved in experiments, evaluating the success of the experiment and planning improvements.

Performance of candidates in both tasks was pleasing with good evidence that they are familiar with practical work and the analysis of practical results. The tasks proved to be accessible for most candidates who usually attempted all questions. Hypotheses were usually well done. Risk assessments were not well done. Candidates were usually able to record their results logically although units were often incorrect. Many had difficulty rounding values correctly. Many produced suitable graphs although some drew non-linear scales. Many struggled to draw lines of best fit. Key terms such as repeatability and reproducibility were well-known, but many candidates were not clear in their responses and consequently lost marks in explanations.

Comments on individual questions/sections

Most candidates were able to make a sensible hypothesis which linked the independent and dependent variable. The exception to this was the exothermic reactions experiment, where many candidates simply stated that the temperature would rise when zinc was added and did not link temperature and time.

In producing risk assessments, the most successful candidates linked the risk with a particular action in the method, such as spilling chemicals onto skin whilst pouring, and were able to suggest a sensible control measure for that risk. Less successful candidates often did not link the risk to an action. It is still common to see reference to chemicals splashing into eyes which earns no credit.

Section A – Tables of results

Most candidates produced a well organised table of results and recorded all their data. It was pleasing to see that most included units in the table headings and not in the body of the table. Incorrect units such as C° or incorrect abbreviations of units (e.g. secs for s / seconds) were commonly seen. In the exothermic reactions task, candidates were instructed to record the time every 30 seconds for 3 minutes. It was common to see 1 minute 30 seconds recorded as 1.3 minutes. Handwriting was an issue for many candidates, and particularly the legibility of numbers.

Section B – Variables

Both tasks included a section on variables. Candidates were usually able to identify the independent and dependent variables, and most were able to state the range of these variables when required. The tasks explored how certain variables were controlled, and in common with previous series there was often no clear indication of the apparatus used or the required value for that variable.

Section B – Graphs

The most successful candidates gained most of the available marks in this section. However, a significant number made the same errors as seen in past series. Marks were lost for non-linear scales and for plotting errors when unusual scales were chosen. Lines of best fit continued to be problematic as many candidates simply joined the first and last point with no consideration of the spread of data above and below the line. Straight lines should not be used to join point-to-point in a Chemistry practical.

Description of the results was often quite limited. Whilst the majority of candidates were able to describe a relationship between the independent and dependent variables in the graph, a description of the shape of the graph, where it was required for the second mark, was poor. In the exothermic reactions task, candidates linked the initial temperature increase to time but did not refer to the subsequent decrease or levelling off.

Section B – Calculations

Across both tasks, where candidates were asked to use equations, calculations were answered well by most candidates.

Section B – Explanation of results

Linking practical results to underlying theory proved again to be challenging for many candidates. In the exothermic reaction task, many candidates failed to clearly link their results to the reaction pathway.

Section B – Use of practical terminology

It was evident that most candidates understood practical terminology such as repeatability, reproducibility and precision and understood what an anomalous result is. The most successful candidates were able to evaluate repeatability and use data to justify their responses. However, many candidates, whilst clearly understanding the meaning of the terminology, gave answers that were too vague for credit, with responses such as '*all* the results are similar', rather than focusing on the similarity of repeat readings. Poorer responses did not refer at all to the data collected.

Section B – Improvements

Many candidates were able to suggest suitable improvements, for example using a lid for insulation in the exothermic reaction task. Where candidates were less successful, they often used vague descriptions of improvements with no suggestion of how or why they would be beneficial to the task. There seemed to be a lack of knowledge or experience of higher precision instruments such as a burette or graduated pipette from candidates in some centres.

Supporting you

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