



Examiners' Report Principal Examiner Feedback

Summer 2025

Pearson Edexcel International GCSE
in Chemistry (4WSD4) Unit 4CR

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A grade boundary is where we set the level of achievement required to obtain a certain grade for the externally assessed unit. We set grade boundaries for each grade, at Distinction, Merit and Pass.

Setting grade boundaries

When we set grade boundaries, we look at the performance of every learner who took the external assessment. When we can see the full picture of performance, our experts are then able to decide where best to place the grade boundaries – this means that they decide what the lowest possible mark is for a particular grade.

When our experts set the grade boundaries, they make sure that learners receive grades which reflect their ability. Awarding grade boundaries is conducted to ensure learners achieve the grade they deserve to achieve, irrespective of variation in the external assessment.

Variations in external assessments

Each external assessment we set asks different questions and may assess different parts of the unit content outlined in the specification. It would be unfair to learners if we set the same grade boundaries for each assessment, because then it would not take accessibility into account.

Grade boundaries for this, and all other papers, are on the website via this [link](#)

Introduction

This is the first examination series for iGCSE Chemistry modular paper 2 (4WSD4/1CR)

The content examined is the same as for the iGCSE Chemistry linear 4DS0 papers, but the total number of marks is 60. This question paper followed a broadly similar format to 4DS0, with seven questions and 31 test items in total. There was a mix of different types of question which included: several multiple-choice questions; single mark questions mainly testing recall or application of knowledge; completion of diagrams or graphs to a high degree of accuracy and precision; a variety of routine and non-routine calculations; 2, 3 and 4 mark questions requiring description or explanation of a chemical idea, process or practical procedure; and an extended response question of 6 marks, which provided candidates with the opportunity to interpret and communicate their understanding of a given context.

The following topics were covered:

- Question 1: catalysis; the effect of a catalyst on the rate of a reaction; identifying the most effective catalyst; sketch a curve to show change in rate of reaction when a catalyst is removed (7b)
- Question 2: identification of metal ion from a flame test colour; describing the test for a carbonate ion / carbon dioxide gas; constructing the formula of a compound from chemical test results (6h, 5f)
- Question 3: giant covalent and simple molecular structures; similarities and differences in physical properties of covalent substances (e.g. electrical conductivity) (5g)
- Question 4: determination of formulae of lead oxides by reduction; practical details of an investigation; word equation for a reaction; constructing a linear graph and finding the gradient; determining empirical formula (1e)
- Question 5: addition polymers; drawing a dot-and-cross diagram of a monomer and a repeat unit of its polymer; calculation of number of repeat units and carbon atoms; understanding problems in using polymers (8h, 5g, 1e)
- Question 6: chemical test for chlorine; reversible reaction involving chlorine; chemical equation for a reversible reaction; changes and observations for the reverse reaction; effect of temperature upon rate of reaction; amount of substance and percentage yield calculation (6h, 1e, 7c, 7b)
- Question 9: halogens; physical properties of halogens; reacting masses calculation; halogen-halide displacement reactions (6f, 1e)

Areas where candidates performed well were:

- recalling the characteristics of catalysts and identifying the most effective – Q1

- performing a routine calculation – Q6
- recalling tests and results for gases and ions – Q2 and Q6
- knowing that delocalised electrons can carry an electrical charge for some covalent substances – Q3
- plotting and analysing graphs – Q4
- identifying addition polymerisation and being able to draw a repeat unit for a common polymer – Q5
- being able to suggest how to reverse a given reaction and some of the observations that might be made – Q6
- explaining the effect of temperature on the rate of reaction – Q6
- deducing order of reactivity from results – Q7

Areas where candidates did **not** perform as well were:

- being able to sketch a graph to fully show the effect of removing a catalyst from a reaction – Q1
- having a complete knowledge of charges of common ions – Q2
- knowing and recognising the main four types of structure – Q3
- comparing two structures and the difference in a physical property (e.g. electrical conductivity, melting point) – Q3
- knowing or understanding steps in the determination of the formula of a metal oxide – Q4
- drawing appropriate best fit lines for plotted data – Q4
- fully completing dot-and-cross diagrams – Q5
- applying stoichiometric ratios in calculations – Q5 and Q7
- extended line of reasoning in explanations – Q3 and Q5

Individual Questions

Question 1

This question was about catalysts and the effect on rate of reaction.

Q1(a)

The majority of candidates were able to suggest an appropriate word or way to end each of the three sentences.

Q1(b)

Almost all of candidates identified catalyst Q as giving the fastest reaction.

Q1(c)

A significant number of candidates were able to sketch a curve that was lower than the original but finished at the same level. Generally when candidates only scored 1 mark, this was for realising that the rate of reaction would be slower without the catalyst and so that the initial gradient of the curve would be less steep.

Question 2

This question was about the identification of an unknown ionic compound from the positive results of two chemical tests.

Q2(a)

Most candidates were able to identify that the lithium ion produced a red flame colour in a flame test.

Q2(b)

The majority of candidates were able to describe the test and result for carbon dioxide and thereby confirm the presence of carbonate ions. Many candidates scored at least two marks, with the main reason for not achieving full marks often being not identifying that the gas was carbon dioxide.

Q2(c)

This question was intended for the very best candidates and the number of correct responses was consistent with this. A range of skills were required. Candidates needed to identify the metal ion from the result in the flow chart, recall the charges of the ions and construct the correct formula. The carbonate formula was often correctly written and it was the metal ion which was incorrect, with the formula for calcium carbonate being commonly observed.

Question 3

This question was about graphite and C₆₀ fullerene.

Q3(a)

Candidates did not perform as well as would have been expected on this question, which was to name the types of structure presented. Both the name of the type of carbon and a diagram of the structure was supplied, which gave candidates different ways to approach this question. However, candidates scoring both marks, or even 1 mark, were in the minority. In some cases, terminology for the names was only partially given or was poorly expressed e.g. "giant lattice", "giant structure". It was common to find that instead of offering names, candidates would try to describe the number of bonds or the shape in some way (e.g. layers, spherical, bee-hive, etc) and some drew geometric shapes or organic molecules for their answer. Occasionally, the structure names were mixed up, or giant metallic and/or giant ionic would be suggested. This would appear to be an area for candidates to be better prepared.

Q3(b)

Again candidates did not perform as well as might have been expected on this question, and only a minority of candidates were able to give a valid response. Although a large number of candidates had just previously given good description of the shape of C₆₀ in Q3(a), this was not further used in answer to this question. The most common answer was "weak intermolecular forces" to explain the use of C₆₀ as a lubricant. Whilst this gained the mark, it did not show a full appreciation of the diagram supplied. It was rare to see a response that suggested that the C₆₀ molecule could roll or move as a result of its shape.

(b) Graphite and C₆₀ fullerene can be used as lubricants.

In graphite, the layers move over each other easily.

Suggest why C₆₀ fullerene molecules move over each other easily.

(1)

Due to its spherical shape

Suggest why C₆₀ fullerene molecules move over each other easily.

(1)

The shape allows The shape is a
a ball thus causing decreased friction

Suggest why C₆₀ fullerene molecules move over each other easily.

(1)

C₆₀ fullerene molecules move over each other
due to its weak intermolecular force of attraction

Principal Examiner comment:

A selection of responses which each score 1 mark.

Q3(c)

This question discriminated well between the best candidates and the rest of the cohort. Only the best candidates were able to give an answer that scored 2 or more marks. In general, most candidates were aware that “delocalised electrons” were the reason for electrical conductivity in graphite. However, it was not well known that C_{60} fullerene molecules also had delocalised electrons, and many concluded that a lack of this was the reason that C_{60} had poor electrical conductivity. Consequently, a more critical comparison of the two structures was not given to explain the difference in conductivity.

(c) Graphite conducts electricity better than C_{60} fullerene.

Explain this difference.

(3)

Graphite: giant covalent structure
covalent bonding
delocalised electrons are free to move
 C_{60} : simple covalent structure
covalent bonding
electrons are not free to move

Principal Examiner comment:

This response scores 1 mark. It was common to see the recognition of delocalised electrons in graphite but not for C_{60} fullerene.

(c) Graphite conducts electricity better than C_{60} fullerene.

Explain this difference.

(3)

graphite has delocalised electrons that move
freely throughout the structure

Principal Examiner comment:

This response scores 2 marks. In addition to identification of delocalised electrons, the candidate has indicated that these can travel throughout the structure for graphite.

(c) Graphite conducts electricity better than C_{60} fullerene.

Explain this difference.

(3)

Graphite has a sea of delocalized electrons that can move freely and conduct electricity.

C_{60} fullerene does have free electrons; however, the electrons can not move from one C_{60} fullerene^{ball} to the next.

Principal Examiner comment:

This response scores 2 marks. The response is too ambiguous for 3 marks, but the candidate does infer that electrons are delocalised or can move in both structures, but that electron movement is restricted to a C_{60} molecule.

Q3 would suggest that the structure and properties of C_{60} fullerene is not an area well known by candidates. Centres are advised to focus more closely upon this part of the iGCSE Science specification.

Question 4

This question was about a practical to determine the formulae of different lead oxides by reduction and plot data to create a linear graph for the comparison of results.

Q4(a)(i) and (ii)

Collectively, the two parts of this question were intended to discriminate between candidates on their knowledge of this practical. It also required some clear expression of how to complete or use measurements from the investigation.

For part (i), candidates were generally able to provide reasonable responses indicating that the difference between the mass of the tube and its contents before and after heating would give the mass of oxygen. Better responses tended to provide an expression showing the subtraction of the mass of the tube with lead from the mass of the tube with lead oxide. Candidates that failed to score did so for various reasons. Some did not consider the context and instead came up with methods of collecting oxygen gas. In some responses, it was unclear what object of mass was being referred to and sometimes there was no reference to "mass" at all, rendering a statement meaningless.

For part (ii), most candidates were either unfamiliar with how to carry out this particular type of investigation or were unable to express themselves with sufficient clarity. Candidates that were able to gain credit on this part tended to

score the second marking point, which was to achieve a “constant mass”. Candidates were less likely to offer that the tube and its contents should be reheated and reweighed until this point was reached.

- (ii) Describe what the scientist should do next to check that the reaction is complete.

(2)

heat again
make sure the mass ^{of tube} doesn't change

Principal Examiner comment:

This response scores 1 mark. The candidate indicates that they are looking for no change in mass after heating, but would need to make clear how they would know this and give a statement that re-weighing of the tube would be needed.

- (ii) Describe what the scientist should do next to check that the reaction is complete.

(2)

keep heating the contents of the tube & reweigh until constant mass.

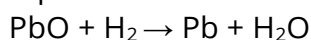
Principal Examiner comment:

This response scores 2 marks. The response is sufficiently clear that the tube and contents are to be re-heated and re-weighed until the mass remains constant.

Q4(a) would suggest that the practical details for the determination of the formula of a metal oxide by reduction are not well known by candidates. Centres are advised to focus more closely upon this part of the iGCSE Chemistry specification.

Q4(a)(iii)

This question met with a varied response by candidates. It was intended to test basic understanding and use of a word equation, although this also required a good appreciation of the context as the secondary product was not stated. Consequently, many candidates did omit water from their equations, either implying that oxygen just disappeared or proposing a different product to lead, such as lead hydroxide. Some did not read the question carefully or chose to overlook that a word equation was required, and provided the chemical equation



Candidates must be clear about the different types of equation that are used to represent reactions and not to simply assume a chemical equation is the default when an “equation” is asked for.

Q4(b)

Whilst many candidates were able to determine the gradient of the linear graph for PbO, many were not. Common errors were to misread the graph, leave the answer as an unresolved fraction, or divide a change in mass of lead (x axis) by a change in mass of oxygen (y axis).

Q4(c)(i), (ii) and (iii)

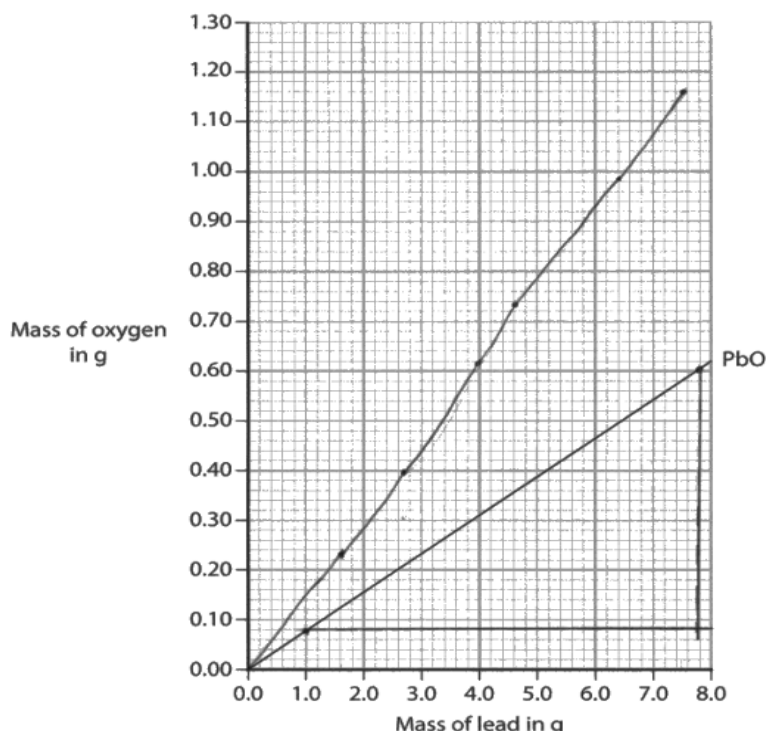
For the unknown compound T, most candidates were able to accurately plot the data on the grid with no or minimal error. Occasionally, candidates would draw extremely large points which were unacceptable as this made the accuracy difficult to ascertain.

The high level of accuracy shown with plotting was not always continued with the line of best fit. Although the data (and the existing graph) suggested a straight line, a worrying number of candidates clearly did not use a ruler. Candidates that did, typically did well as there were no obvious anomalies in the data to worry about.

The deduction of the empirical formula for compound T required candidates to make use of the graphs, but was an atypical approach. Some candidates resorted to determining a stoichiometric ratio for lead and oxygen to arrive at the formula. This was credited but was more work than was required. More efficient candidates observed that for any given mass of lead, the mass of oxygen was always double for compound T compared to PbO. Occasionally, the gradient of the graph for compound T was determined and compared with the answer for (b).

(b) The experiment in part (a) is repeated using different masses of PbO.

The graph shows the masses of lead and oxygen found in these experiments.



Principal Examiner comment:

This response scored 1 mark for part (i) but 0 marks for part (ii), as the best fit line is clearly not straight.

Question 5

This question was about addition polymerisation, completing a dot-and-cross diagram for an organic molecule, drawing the displayed formula of a repeat unit of poly(chloroethene) and problems with the use of inert polymers.

Q5(a)

Most candidates were able to identify the type of polymerisation. Common incorrect answers included “condensation” and “synthetic”, whilst other candidates misinterpreted the question and offered compound names or formulae.

Q5(b)

Most candidates scored at least one mark for their dot-and-cross diagram of chloroethene, but only the best candidates were able to correctly complete the diagram. The majority of these responses showed that the carbon-carbon overlap was completed with four electrons, but that the chlorine atom was not fully completed.

Q5(c)

Many candidates were able to draw the displayed formula for one repeat unit of poly(chloroethene) correctly. Common errors tended to be to omit the

extension bonds from the carbon atoms, show a double bond in the diagram or forget the Cl atom.

Q5(d)

Although this calculation involved fairly basic processing, candidates found the final step of this non-routine problem challenging. Careful understanding of what was being asked by the question was needed and discriminated the best candidates from the rest of the cohort. Most candidates were able to calculate the number of repeat units within the poly(chloroethene) chain, but relatively few realised that as there were two carbon atoms per repeat unit, the final answer should be doubled.

Q5(e)

Most candidates were able to score at least one mark on this question, but many were unable to expand fully. A number of candidates simply stated what inert meant rather than explore what the issue may be arising from this. Other candidates tried to discuss methods of disposal (e.g. burning, need for landfill sites) which missed the point of the question. Better candidates were able to link the inert behaviour with the difficulty in breaking down poly(chloroethene). Only the best candidates were able to build upon this specifically using the context.

(e) Poly(chloroethene) is suitable for making underground water pipes because it is inert.

Explain a problem caused by poly(chloroethene) being inert.

(2)

poly(chloroethene) is not biodegradable as it is inert therefore it stays in the environment for thousands of years and harms the environment and wildlife as they may eat it.

(Total for Question 6 = 9 marks)

Principal Examiner comment:

This response scores 2 marks. The response links that poly(chloroethene) being inert makes it non-biodegradable. Although aspects of the rest of the answer could do with clarification, the expansion correctly implies that the material will remain in the environment for a long time, rather than how it should be disposed of.

Question 6

This question was about testing for chlorine, a reversible reaction involving chlorine, the changes to reverse the reaction, the effect of temperature on the rate of reaction, and calculation of percentage yield for the reaction.

Q6(a)

Most candidates were able to give the test and result for the identification of chlorine. Where a candidate did not score both marks, it was normally for an imprecise answer such as the omission of "damp" litmus paper. The most common incorrect answer tended to be when the test was confused with the test for the chloride ion.

Q6(b)

The majority of responses showed the symbol for a reversible arrow, but the formulae of the substances were not always correct (e.g. molecular chlorine) or should not present (e.g. molecular iodine). State symbols were dependent upon the formulae being correct or recognisable. The most common error was the use of the aqueous state symbol.

Q6(c)(i) and (ii)

Both questions saw most candidates score at least one mark. In part (i), the majority of responses suggested heating the crystals or removing the ice.

In part (ii), many candidates were able to identify that the starting point of the observation involved the crystals disappearing or melting, which followed on from part (i). Candidates often correctly indicated that this change resulted in a brown liquid. The production of more green gas was usually only mentioned as an additional observation in better responses rather than as an alternative suggestion. When candidates did not score this was usually because names or formulae were referred to rather than observations. Other errors included that changes in conditions were discussed or the observed change was given the wrong way round.

(ii) Describe what would be observed during the reverse reaction.

(2)

~~A yellow crystal is formed after 15 minute~~
The colour of chlorine gas at is getting paler overtime because
most of the chlorine gas is used to make ICl_3 which is a yellow
crystal.

Principal Examiner comment:

This response scores 0 marks. The answer is not entirely clear but would suggest that chlorine gas is reacting to make iodine trichloride, which would be the wrong direction. Despite the focus upon the identities of substances, the description of the observation would be good for the forwards reaction.

Q6(d)

A range of marks were awarded to responses for this question. Despite the question being about the effect of ice on the rate of the reaction, some candidates attempted to explain the effect upon the direction of the reversible reaction. However, most candidates were able to identify that ice would reduce the rate of reaction, explaining that particles would have less energy and that less frequent collisions would occur. When candidates lost marks for this correct approach it was usually because either particles and/or the frequency of collisions was not referred to. Only the best responses remembered to link the use of ice to a lower temperature in comparison with room temperature.

Q6(e)

This question was generally well answered by candidates, with many scoring all 3 marks. A common error was initially to calculate the relative molecular mass for the wrong formula e.g. ICl rather than ICl_3 .

Question 7

This question was about the physical properties of halogens, a reacting mass calculation, and the interpretation of a series of displacement reactions to determine which halogen was present in a solution.

Q7(a)

In this multiple choice question, many candidates were able to apply their understanding of the colour trend in group 7 to identify the halogen with the palest colour as being fluorine.

Q7(b)

This multiple choice question required some data analysis. Many candidates identified option C as the correct option - the melting point was above room temperature but the boiling point was below the maximum temperature from a Bunsen burner flame.

Q7(c)

Candidates that attempted this calculation were typically able to determine the amount of moles of bromine being used. More commonly, candidates were able to score at least 2 marks and very clear working was seen. Full marks was often not scored because the stoichiometric ratio shown in the equation had not been applied.

Q7(d)

The question met with mixed responses from candidates, with a range of marks being awarded. Candidates were aware from the context that this question was about halogens and displacement, but some did not appreciate that this was limited to chlorine, bromine and iodine. Many candidates set about discussing the results but did not have a clear line of interpretation to follow. Candidates

that correctly identified the trend in reactivity for the halogens at the start of their response would gain a mark if correct, and this often led to further marks. It was rarer for candidates to also state that halogen colours became darker down the group. Many were unable to clearly state how a darker colour change indicated that displacement had taken place, which was key to interpreting the results. This could sometimes be awarded within a candidate's explanation of the results. A common misconception was that because a more reactive halogen was paler in colour, a result with a paler colour change indicated a reaction. It was often the case that candidates made assumptions that a darker colour meant a specific halogen, such as bromine. In spite of whether knowledge of the trends of the halogens was shown or not, it was the case that many candidates did give a good rationale for identities of solutions, based upon the number of similar colour changes or an order of reactivity with halides. The only weakness here tended to be whether there had been a full consideration of solution X / bromine, as there was sometimes just reference to the reaction with potassium iodide and no clear acknowledgement of there being no reaction with potassium chloride.

Explain how the results show which halogen is in solution X, which halogen is in solution Y and which halogen is in solution Z.

In your answer, refer to:

- what the colour change indicates
- the order of reactivity of the halogens.

(6)

Because, solution Y can't react with all solution and can't displace all elements so it has the least reactivity.
 Solution X can't react with potassium iodide solution so it can displace I, its reactivity is bigger than I.
 Solution Z can react with KBr and KI displace Br, I so its reactivity is bigger than Br, I.
 reactivity $Cl > Br > I$
 Because, ~~it react~~ solution X is Br solution Y is I, solution Z is Cl. ~~the color of Cl is the palest,~~ add KCl, color turns paler, add KBr solution ^{Cl} turns darker, add KI solution, solution ^{Br} and ^{Cl} turns darker.

Principal Examiner comment:

This response scores 3 marks. The candidate has immediately started with an interpretation of the results for each solution. The interpretation has some logic but is only just coherent. The order of reactivity of the halogens is only established later and then the correct identification of the solutions follows this. However, there is no clear statement about what a darker or paler colour signifies. The rationale for the identities of solutions Y and Z is acceptable, but this is only partially given for solution X and so marking point M4 has not been awarded.

Explain how the results show which halogen is in solution X, which halogen is in solution Y and which halogen is in solution Z.

In your answer, refer to:

- what the colour change indicates
- the order of reactivity of the halogens.

→ ordered in each solution.
3 at a time.

(6)

Solution X is Bromine, Solution Y is Iodine and solution

Z is Chlorine. ~~Reactive~~ whereas, chlorine is most
reactive and iodine is least reactive, solution X,

① Bromine has no effect on ~~chloride solution~~ potassium chloride
solution, Bromine cannot displace itself, ^{so doesn't take place.} Bromine displaces iodine

thus potassium iodide. the solution turns brown. Secondly,

Solution Y, Iodine has no effect on potassium chloride

nor potassium iodide bromide. and obviously iodine cannot displace

itself in potassium iodide solution. so it doesn't take place.

Finally, solution Z which is chlorine, at start it chlorine

cannot displace itself in potassium chloride solution. and

chlorine displaces both potassium bromide and iodide. the
solution turns orange ^{when chlorine displaces bromine.} ~~after potassium~~

and turns brown when chlorine displaces iodine.

therefore, the solution ^{circle} turns pale indicates, the
reaction didn't happen or as it cannot displace itself

or is lower than the other element's reactivity series.

and the solution turns darker circle indicates it either
it displaces the other element

(Total for Question 9 = 11 marks)

successfully and changes color of solution.

Principal Examiner comment:

This response scores 5 marks. The candidate has begun by correctly identifying the three solutions and indicates the most and least reactive halogen, which is reinforced

throughout the response. The identity of each solution is then carefully justified, result by result. The response concludes with a good account of what pale and dark circles mean in terms of whether a reaction has occurred or not and why. All that is missing here is some comment to link halogens further down the group (or less reactive halogens) being darker in colour than those that are higher (or more reactive).

Summary

Based upon performance within this paper, it is recommended that candidates:

- use chemical terminology more often and with greater accuracy, such as when explaining the effect of structure on physical properties
- use comparative words or links within explanations where a question indicates that two substances or two conditions are being considered
- develop logical explanations for extended response answers
- understand or provide the reasons for steps in practical work, particularly investigations specified in the specification content
- know exact observations for standard tests and reactions, and be able to describe these fully
- practice non-routine calculations which involve additional steps, such as stoichiometric changes and excess reactants
- be able to recall ion charges, use these to write formulae or deduce them from given formulae
- be able to combine different pieces of information and knowledge to solve a problem, such as the use of chemical tests or other reactions to identify a formula or substance.

