



Rewarding Learning

General Certificate of Secondary Education

**Double Award Science
Chemistry**

Unit C1

Higher Tier

[GDW22]

Assessment

**MARK
SCHEME**

General Marking Instructions

Introduction

Mark schemes are intended to ensure that the GCSE examinations are marked consistently and fairly. The mark schemes provide markers with an indication of the nature and range of candidates' responses likely to be worthy of credit. They also set out the criteria which they should apply in allocating marks to candidates' responses.

Assessment objectives

Below are the assessment objectives for GCSE Double Award Science.

Candidates must:

- AO1** Demonstrate knowledge and understanding of:
- scientific ideas; and
 - scientific techniques and procedures;
- AO2** Apply knowledge and understanding of and develop skills in:
- scientific ideas; and
 - scientific enquiry, techniques and procedures; and
- AO3** Analyse scientific information and ideas to:
- interpret and evaluate;
 - make judgements and draw conclusions; and
 - develop and improve experimental procedures.

Quality of candidates' responses

In marking the examination papers, examiners should be looking for a quality of response reflecting the level of maturity which may reasonably be expected of a 16-year-old which is the age at which the majority of candidates sit their GCSE examinations.

Flexibility in marking

Mark schemes are not intended to be totally prescriptive. No mark scheme can cover all the responses which candidates may produce. In the event of unanticipated answers, examiners are expected to use their professional judgement to assess the validity of answers. If an answer is particularly problematic, then examiners should seek the guidance of the Supervising Examiner.

Positive marking

Examiners are encouraged to be positive in their marking, giving appropriate credit for what candidates know, understand and can do rather than penalising candidates for errors or omissions. The exception to this for GCSE Double Award Science is when examiners are marking complex calculations when the Examiners are briefed to mark by error or omission. Examiners should make use of the whole of the available mark range for any particular question and be prepared to award full marks for a response which is as good as might reasonably be expected of a 16-year-old GCSE candidate.

Awarding zero marks

Marks should only be awarded for valid responses and no marks should be awarded for an answer which is completely incorrect or inappropriate.

Marking Calculations

In marking answers involving calculations, examiners should apply the 'carry error through' rule so that candidates are not penalised more than once for a computational error. To avoid a candidate being penalised, marks can be awarded where correct conclusions or inferences are made from their incorrect calculations.

Types of mark schemes

Mark schemes for tasks or questions which require candidates to respond in extended written form are marked on the basis of levels of response which take account of the quality of written communication.

Other questions which require only short answers are marked on a point for point basis with marks awarded for each valid piece of information provided.

Levels of response

In deciding which level of response to award, examiners should look for the number of indicative content points in candidate responses to ensure that the answer has been written to coincide with the question. In deciding which mark within a particular level to award to any response, quality of communication will be assessed and examiners are expected to use their professional judgement.

The following guidance is provided to assist examiners.

- **Threshold performance:** Response which just merits inclusion in the level and should be awarded a mark at or near the bottom of the range.
- **High performance:** Response which fully satisfies the level description and should be awarded a mark at or near the top of the range.

Quality of written communication

Quality of written communication is taken into account in assessing candidates' responses to all tasks and questions that require them to respond in extended written form. These tasks and questions are marked on the basis of bands of response. The description for each band of response includes reference to the quality of written communication.

For conciseness, quality of written communication is distinguished within bands of response as follows:

Band A: Quality of written communication is excellent.

Band B: Quality of written communication is good.

Band C: Quality of written communication is basic.

Band D: Response not worthy of credit.

In interpreting these band descriptions, examiners should refer to the more detailed guidance provided below:

Band A (Excellent): Excellent reference to scientific terminology. The candidate successfully selects and uses the most appropriate form and style of writing. Relevant material is organised with a high degree of clarity and coherence. There is widespread and accurate use of appropriate specialist vocabulary. Presentation, spelling, punctuation and grammar are of a sufficiently high standard to make meaning clear.

Band B (Good): Good reference to scientific terminology. The candidate makes a reasonable selection and use of an appropriate form and style of writing. Relevant material is organised with some clarity and coherence. There is some use of appropriate specialist vocabulary. Presentation, spelling, punctuation and grammar are sufficiently competent to make meaning clear.

Band C (Basic): Basic reference to scientific terminology. The candidate makes only a limited selection and use of an appropriate form and style of writing. The organisation of material may lack clarity and coherence. There is little use of specialist vocabulary. Presentation, spelling, punctuation and grammar may be such that intended meaning is not clear.

General marking guidance in applying mark schemes for GCSE DAS Chemistry

1. Alternative responses

- A solidus (/) used in mark schemes indicates alternative answers. Where a solidus may be confused with part of the answer (for example as a division sign or as part of units) “or” may be used to show alternatives.

Example: What is meant by the term element? [1]

MS: A substance which contains only one type of atom/substance which cannot be broken down into anything simpler by chemical means [1]

- Either answer as a response would be acceptable. If both are given this is accepted.

2. Brackets in a response

- Normal parentheses used in a mark scheme response means that the word(s) given in brackets **are not required** for the response to be marked correct.

Example: Name the chemical used to test for carbon dioxide. [1]

MS: limewater/calcium hydroxide (solution) [1]

Response	Candidate Response	Marks awarded	Notes
1	limewater	1	Correct response
2	calcium hydroxide	1	Correct response
3	calcium hydroxide solution	1	Correct response

- Calcium hydroxide on its own is an acceptable response to this question as the focus is on the chemical as opposed to solution.
- Note that in a practical style question, solution may be expected if the candidate chooses to describe limewater as “calcium hydroxide solution”.*

3. Words or phrases in bold in a response

- Words or phrases highlighted in bold in a mark scheme response mean that the word(s) or phrases or their equivalent, if applicable, **are required** for the response to be marked correct.

Example: Describe the test for ammonia gas. [3]

MS: Dip a **glass** rod [1] in **concentrated hydrochloric acid** [1] and then in a sample of the gas. Idea that **white** smoke/**white** fumes is/are formed [1]

Response	Candidate Response	Marks awarded	Notes
1	Dip a rod in hydrochloric acid and then in the gas. White smoke means it is ammonia.	1	“glass” and “concentrated” not stated
2	Put a glass rod into concentrated acid and then into ammonia. You will see white fumes.	2	“hydrochloric” not stated
3	Put a glass rod into concentrated hydrochloric acid and then into the ammonia. A white smoke is formed.	3	Correct response

4. Marking of lists

- Where candidates give extra responses, additional correct responses can be ignored.
- Additional neutral responses can also be ignored. A neutral response is one which does not have a bearing on the question but is not incorrect.
- Additional incorrect responses **cancel out** a correct response to the marking point to which they pertain.

Example: Name the ore from which iron is extracted. [1]

MS: haematite [1]

Response	Candidate Response	Marks awarded	Notes
1	haematite (bauxite)	0	Bauxite is incorrect
2	haematite (iron oxide)	1	Iron oxide is a neutral answer
3	iron oxide	0	Not the correct answer
4	iron(III) oxide	0	Not the correct answer
5	haematite (iron(III) oxide)	1	Iron(III) oxide is a neutral answer
6	Bauxite (iron(III) oxide)	0	Bauxite is incorrect

5. Marking values where a range is given

- Where a numerical range is given, correct responses are any value in the range, the range itself or any other range given which falls within the MS range.

Example: What is the pH of a solution of hydrochloric acid? [1]

MS: 0–2 [1]

Response	Candidate Response	Marks awarded	Notes
1	0	1	A single value within the accepted range
2	1.5	1	A single value within the accepted range
3	2	1	A single value within the accepted range
4	0–2	1	The accepted range
5	1–2	1	A range given within the accepted range
6	1–3	0	Range given outside the accepted range
7	2.5	0	A single value not within the accepted range

6. Names and chemical formulae

(a) Names, formulae and identification

- If a candidate writes a symbol for an element or chemical formula to **identify** an element or compound this can be marked correct **unless** a name is specifically required as detailed in the question.

Example: Which substance undergoes catalytic decomposition in the laboratory preparation of oxygen? [1]

MS: hydrogen peroxide/H₂O₂ [1]

i.e. either the name or the formula can be given

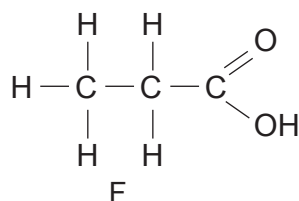
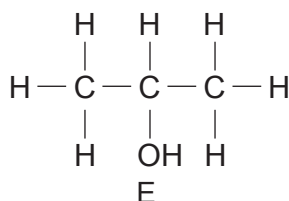
- If the command word "*Identify*" is used, a candidate may provide either the name or symbol/formula. When the command word "**Name**" (in bold) is used, only the correct name will be awarded the mark.

Example: **Name** the substance which undergoes catalytic decomposition in the laboratory preparation of oxygen? [1]

MS: hydrogen peroxide [1]

- There are examples where the command word "*Name*" is used but it is not in bold, but it should be obvious that a name is required.

Example: Name compounds E and F.



[2]

MS: E = propan-2-ol [1]

F = propanoic acid [1]

[2]

Chemical formulae for these compounds would **not** be accepted as the command word is "**name**". With names such as these the full name with number and dashes for propan-2-ol is required.

(b) Both name and formula provided by candidate

- If a name is required and a candidate gives both a name and a chemical formula, the formula can be ignored even if it is incorrect.
- If a name is required and a candidate gives an incorrect name and a correct chemical formula the answer must be marked wrong.
- If a formula is required and both the name and formula are given, the name can be ignored even if it is incorrect.

Example: **Name** the salt produced when sodium hydroxide reacts with hydrochloric acid. [1]

MS: sodium chloride [1]

Response	Candidate Response	Marks awarded	Notes
1	sodium chloride NaCl ₂	1	Incorrect formula ignored
2	sodium chlorate NaCl	0	Name is incorrect

(c) Formula asked for but equation containing the correct formula given

- If a question asks for a formula and the candidate writes an equation on the answer line, then even if the formula in that equation is correct there is no credit because the candidate has not answered the question correctly.

Example: Give the formula of the salt formed when magnesium reacts with nitric acid. [1]

MS: $\text{Mg}(\text{NO}_3)_2$ [1]

- A response such as: $\text{Mg} + 2\text{HNO}_3 \rightarrow \text{Mg}(\text{NO}_3)_2 + \text{H}_2$ gains no credit because the candidate has provided an equation (with four formulae).

(d) Oxidation states

- Where an element has variable oxidation states, the oxidation state should be given where this is indicated in the mark scheme. However, with copper(II) compounds, the (II) can be omitted in the name.
- Where an element has variable oxidation states and a name is required, the oxidation state should be given, e.g. hydrated iron(III) oxide.

Example: Which catalyst is used in the decomposition of hydrogen peroxide? [1]

MS: manganese(IV) oxide/manganese dioxide/ MnO_2 [1]

- Manganese oxide would not be accepted.
- The (IV) is required unless manganese dioxide or MnO_2 is given.
- Manganese(IV) dioxide would also be incorrect.

7. Marking equations

Some general points about formulae and equations:

- A missing \rightarrow in any equation is penalised by 1 mark.
- If only the left hand side(LHS) or only the right hand side(RHS) are given with no \rightarrow then no credit can be given.
- If only one side is given and an arrow is shown then that side can be credited, e.g. $\text{Na} + \text{H}_2\text{O} \rightarrow$ can get the LHS mark.
- Mark the equation which has been written on the line or the equation closest to the line if several "answers" are given and not crossed out.
- Do **not** penalise a cursive A (for example for Al) or N (for example for N or Na).
- Do **not** penalise lower case single symbols such as S or O unless it is **extremely** clear that it is lower case.
- Penalise use of capital letter for second letter of element symbols: CL is incorrect if it is a clear right-angle capital; NA is incorrect even if the A is smaller.
- Only penalise letter errors once in an equation (or even in a paper) if a symbol is repeated so mark the equation as normal but penalise 1 mark if there is a very clear symbol error which would appear on both sides of the equation.
- Ignore state symbols, unless they are asked for in the question, even if incorrect.
- For standalone formulae of ionic compounds or when written in an equation, two charges are acceptable, e.g. Na^+Cl^- is acceptable but Na^+Cl is **not** acceptable.
- A bracket is acceptable around a molecular ion even if only one is required, $\text{Na}(\text{OH})$ is accepted but a bracket is **not** accepted around a single element so $(\text{H})_2\text{O}$ is **not** correct.

(a) Balanced symbol equations and ionic equations

- A balanced symbol equation or ionic equation without state symbols is either worth 2 marks or 3 marks. State symbols are an additional mark.
 - Multiple or fractional balancing numbers which are correct are accepted.
- (i) A 3 mark balanced symbol equation requires balancing numbers.
[1] mark is awarded for the correct formula(e) of the reactants.
[1] mark is awarded for the correct formula(e) of the products.
The third mark, the balancing mark, is only available if all formulae are correct; if they are and balancing is correct, award [3] in total.
- (ii) A 2 mark balanced symbol equation does not require balancing numbers.
[1] mark is awarded for the correct formula(e) of the reactants OR the correct formulae of the products
[1] mark is awarded for the correct formula(e) of the other side of the equation AND balancing.

Example: Write a balanced symbol equation for the reaction of magnesium with sulfuric acid.



correct formulae of reactants (LHS) OR correct formulae of products (RHS) [1]

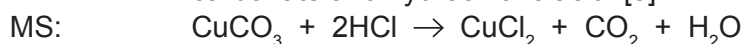
correct formula for other side of the equation AND balancing correct [1] [2]

- When considering the **first** mark only look at the formulae; ignore any balancing; if one side of the equation has the correct formula(e), the first mark is awarded.
- When considering the **second** mark look at the formulae on the other side of the equation (from that credited with the first mark) AND at the balancing – the second mark is only awarded if all the formula(e) are correct and the balancing is also correct.

Response	Candidate Response	Marks awarded	Notes
1	$\text{Mg}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{MgSO}_4 + \text{H}_2\text{O}$	0	Neither LHS or RHS has correct formulae so no credit
2	$\text{Mg}_2 + \text{H}_2\text{SO}_4 \rightarrow 2\text{MgSO}_4 + \text{H}_2$	1	The RHS has both formulae correct so gets [1] the LHS has a wrong formula so no credit
3	$\text{Mg} + \text{H}_2\text{SO}_4 \rightarrow 2\text{MgSO}_4 + \text{H}_2$	1	The LHS has both formulae correct so gets [1]; the RHS has both formulae correct but balancing wrong overall so no credit
4	$2\text{Mg} + 2\text{H}_2\text{SO}_4 \rightarrow 2\text{MgSO}_4 + 2\text{H}_2$	2	All formulae correct; doubling up doesn't negate the balancing mark.

- (iii) A 3 mark balanced symbol equation requires balancing numbers.
The mark for balancing numbers is **dependent** on all the formulae being correct.

Example: Write a balanced symbol equation for the reaction between copper(II) carbonate and hydrochloric acid. [3]



correct formulae of reactants (LHS) [1]

correct formulae of products (RHS) [1]

correct balancing [1]

Response	Candidate Response	Marks awarded	Notes
1	$\text{CuCO}_3 + \text{HCl} \rightarrow \text{CuCl}_2 + \text{CO}_2 + \text{H}_2\text{O}$	2	LHS and RHS marks awarded but balancing mark not awarded.
2	$\text{Cu}_2\text{CO}_3 + 2\text{HCl} \rightarrow \text{CuCl}_2 + \text{CO}_2 + \text{H}_2\text{O}$	1	LHS mark not awarded as formula incorrect so balancing mark cannot be awarded. RHS mark awarded.
3	$\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{CO}_2 + \text{H}_2\text{O}$	2	There is a symbol error in this equation so if Cu was correct on both sides it would be worth 3 marks but the single symbol error is penalised by 1 mark.
4	$\text{CuCO}_3 + \text{HCl} \quad \text{CuCl}_2 + \text{H}_2\text{O} + \text{CO}_2$	1	Equation is not balanced and the arrow is missing. 2 marks awarded for LHS and RHS but 1 error for missing arrow so worth 1 overall.

(b) Half equations

- Note that e is acceptable for e⁻.
- Half equations marking details are provided within the mark schemes for each specific question and in general they are marked as follows:

Where there are 3 species in the equation – e.g. ion, molecule and electron [2] marks are available

- correct atom/ion/molecule on left, with arrow and correct atom/ion/molecule on right [1]
- +e⁻ on the correct side (or –e⁻ on the other side) AND correct balancing [1]
- Note that the second mark is dependent on the first

Example: Write a half equation for the reaction occurring at the anode during the extraction of aluminium by electrolysis. [2]

MS: $2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}^-$ OR $2\text{O}^{2-} - 4\text{e}^- \rightarrow \text{O}_2$
 Correct ion on LHS with arrow and correct molecule on RHS [1]
 +e on correct side (or –e on other side) AND correct balancing [1] [2]

Response	Candidate Response	Marks awarded	Notes
1	$2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}^-$	2	All marks awarded as correct with +e ⁻ on RHS.
2	$2\text{O}^{2-} \rightarrow \text{O}_2 - 4\text{e}^-$	1	First mark only awarded as –e ⁻ on RHS is incorrect.
3	$2\text{O}^- \rightarrow \text{O}_2 + 2\text{e}^-$	0	No marks awarded as formula of oxide ion is incorrect.
4	$\text{O}_2 + 4\text{e}^- \rightarrow 2\text{O}^{2-}$	0	No marks awarded as equation shows oxide being formed.

8. QWC

- Quality of written communication is marked using indicative content and a banded mark scheme.
- The initial marking is for the indicative content. The number of indicative content marks places a candidate in a specific band. The total marks awarded will be one of the two mark options in that band based on the standard of written communication.
- A typical banded grid from a mark scheme which would have 8 indicative content points is shown below:

Band	Response	Mark
A	Candidates must use appropriate specialist terms including a minimum of 7 points of indicative content. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates must use appropriate specialist terms including a minimum of 5 points of indicative content. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates provide a brief and partial response including a minimum of 2 points of indicative content. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. The form and style are of a limited standard.	[1]–[2]
D	Response not worthy of credit.	[0]

[6]

- A candidate who provides 5 indicative content points is placed in band B and can be awarded 3 or 4 overall marks out of 6 for their response.
- Responses would normally only be given the lower mark in the band if there were multiple spelling, punctuation and grammar errors.

9. Marking calculations

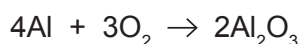
- Any errors in a single calculation or between parts of a multipart calculation may be carried forward. ECF may be used to indicate where an error is carried forward. For example, the incorrect use of the ratio/no ratio used in a reacting mass calculation could be awarded 2 out of the 3 marks available, provided all other steps are carried out correctly.
- Full marks can be awarded for a correct numerical answer to any calculation even if no working out is shown **apart** from degree of hydration and empirical formula calculations for which working out is required.
- Candidates should avoid excessive rounding such as to 1 decimal place unless appropriate or when it does not greatly affect the answer to the question. Any required number of decimal places will be asked for in the question.
- Units are required where they are not provided at the end of an answer line.

Example: Calculate the mass of aluminium oxide formed when a sample of 2.42 g of aluminium is heated to constant mass.

Relative atomic mass: Al = 27

Relative formula mass Al_2O_3 = 102

The equation for the reaction is:



[3]

MS: 4.57 g [3]
Up to 2 method marks may be awarded

$$\text{e.g. moles of Al} = \frac{2.42}{27} = 0.0896 \text{ [1]}$$

$$\text{moles of Al}_2\text{O}_3 = \frac{0.0896}{2} = 0.0448 \text{ [1]}$$

$$\text{mass of Al}_2\text{O}_3 = 0.0448 \times 102 = 4.57 \text{ g [1]} \quad [3]$$

- Note that the space where the answer is to be written will have g at the end of the line so g is not required in the answer.
- The method marks are allocated for the numerical answers/computations as appropriate.
- Responses do not need to include “moles of Al” as it may be presented below the equation or just have “Al” or be clear from the layout of the answer.
- Essentially if a candidate has made 1 error and the work is clearly shown then 2 marks can be awarded.

Response	Candidate Response	Marks awarded	Notes
1	$\text{Al} = \frac{2.42}{27} = 0.1$ $\text{Al}_2\text{O}_3 = 0.05$ $\text{Al}_2\text{O}_3 = 0.05 \times 102 = 5.1 \text{ g}$	2	The rounding in the first line has a significant effect on the answer so the first mark is not awarded. The second and third marks are awarded as this rounding error is carried forward.
2	$\text{Al} = \frac{2.42}{27} = 0.09$ $\text{Al}_2\text{O}_3 = 0.045$ $\text{Al}_2\text{O}_3 = 0.045 \times 102 = 4.59 \text{ g}$	3	All marks are awarded as the rounding here does not have a significant effect on the answer.
3	$\text{moles of Al} = 0.048$ $\text{moles of Al}_2\text{O}_3 = 0.024$ $\text{mass of Al}_2\text{O}_3 = 2.448 \text{ g}$	2	The first mark is not awarded but the second and third marks are awarded as the error is carried through.
4	4.57	3	All marks are awarded for the correct numerical answer. Units are not required as they would be provided at the end of the answer line in the question.
5	$\text{moles of Al} = 0.0896$ $\text{moles of Al}_2\text{O}_3 = 0.1792$ $\text{mass of Al}_2\text{O}_3 = 18.3 \text{ g}$	2	The ratio is not applied correctly here so the second mark is not awarded but the first and third steps in the calculation are carried out correctly.

10. Colours and colour changes

- The colours and colour changes are given in the mark schemes. Shades (such as light and dark) are ignored except where they are clearly part of the mark scheme.
- Incorrect colours with the correct colour will lose the mark as this is an example of an inconsistent response.

11. Definitions

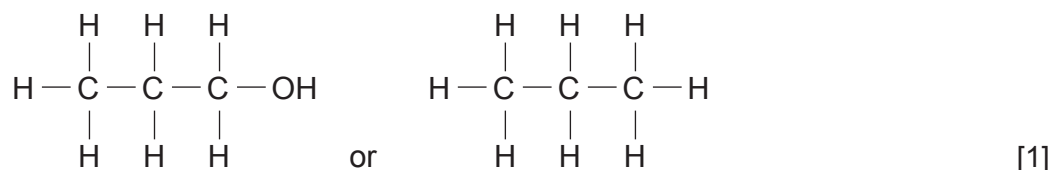
- Definitions are often worth 1 mark but those that have multiple parts are marked based on the distribution of marks detailed in the mark scheme.
- Minor errors with prepositions and conjunctions within the wording should not be penalised if they do not change the meaning of the answer given.

12. Organic structures

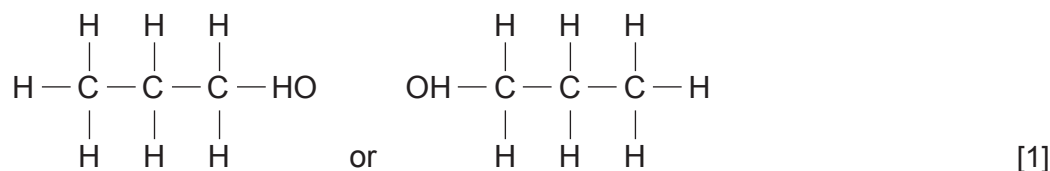
- Each organic structure is generally worth 1 mark.
- Any omission of a bond or an atom from the structure will lose the candidate the mark.
- Connectivity of atoms should only be penalised when it is very obviously wrong. This applies mostly to the OH group for alcohols.

Example: Draw the structural formula of propan-1-ol. [1]

MS:



- The structures below would not be awarded the mark due to connectivity issues with the OH group.



- Note that the bond between the O and H is not required unless the question asks for all bonds to be shown.

13. Marking diagrams

- Diagrams of assembled apparatus are expected to be two-dimensional cross-sectional diagrams of the apparatus where appropriate.
- The marks awarded for an apparatus diagram are usually based on 1 or 2 marks being awarded for labelling recognisable piece(s) of apparatus in an assembled diagram.
- NB apparatus needs to be assembled and to work in order to gain full credit e.g. if a labelled diagram for filtration is required then simply drawing, as separate pieces, a funnel, a conical flask and filter paper would not gain credit; If the diagram showed a labelled filter funnel above a labelled conical flask but the filter paper was missing the candidate could gain 2 out of 3 marks; if the diagram was correct but no labels then 2 out of 3 marks would be awarded.
- In some diagrams a combination of pieces of apparatus may be worth 1 mark such as a gauze on a tripod with a Bunsen burner/heat. All must be recognisable in a diagram of assembled apparatus and labelled correctly for the combined mark to be awarded.

			AVAILABLE MARKS	
1	(a)	simple distillation [1] paper chromatography [1] filtration [1] fractional distillation [1]	[4]	8
	(b)	idea of using an evaporating dish/basin [1] heat/evaporate to point of crystallisation/to reduce volume [1] allow/leave to cool and form crystals [1]	[3]	
	(c)	yellow/orange or yellow or orange	[1]	
2	(a)	(good) electrical conductors, (good) heat conductors, high melting points, malleable, ductile, sonorous. Any 2 × [1]	[2]	7
	(b)	alkaline earth metals correctly shaded and labelled AE [1] halogens correctly shaded and labelled H [1]	[2]	
	(c) (i)	a layer of graphite [1] which is a single atom thick [1]	[2]	
	(ii)	in the same physical state	[1]	

3 Indicative Points

How stored and what is observed if a piece of sodium is cut:

- stored under oil
- and any **two** of:
- clear idea of being shiny when (freshly) cut
 - clear idea of tarnishing / going dull (quickly)
 - explicit idea of being easily cut (not just soft)
- i.e. Maximum of **three** indicative points

Observations when sodium reacts with water:

- (it) floats
- (it) moves about (on the surface – implied)
- (it) melts/forms a ball
- (it) dissolves/disappears/forms colourless solution
- fizzing/bubbles/effervescence/gas given off **not** gas produced
- idea of very rapid reaction
- heat evolved/given off/released
- can catch fire/spark – unless wrongly qualified, e.g. if wrongly coloured flame given

Maximum **four** indicative points*

Ways in which reaction of potassium with water is different to that of sodium:

- Reaction with potassium is faster/more vigorous (or vice versa), e.g. potassium can explode/potassium disappears very quickly
- Potassium catches fire **immediately**
- Potassium burns with a lilac flame

Maximum **two** indicative points*

Band	Response	Mark
A	Candidates must use appropriate scientific terms throughout to describe the storage, relevant observations and reactivity of the alkali metals using 7–9 of the points in the indicative content .They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates use 4–6 points from the indicative content to describe the storage, relevant observations and reactivity of the alkali metals. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates use 2–3 of the points from the indicative content to describe the storage, relevant observations and reactivity of the alkali metals. They use limited spelling, punctuation and grammar and make little use of scientific terms. The form and style are of a limited standard.	[1]–[2]
D	Response not worthy of credit.	[0]

[6]

AVAILABLE
MARKS

6

4 (a) (i) Zirconium [1]

(ii)

Formula	Number of protons	Number of neutrons	Number of electrons
Zr	40	51	40
Zr ⁴⁺	40	51	36

Zr all 3 correct [2]; 2 correct [1]

Zr [1] apply e.c.f. – only change from Zr is 4 fewer electrons [1] [3]

(b) atoms (of an element) with the same atomic number/same number of protons [1] but a different mass number/different number of neutrons [1] [2]

(c) 91.32 [3]

Up to [2] method marks can be awarded if the answer is incorrect,

e.g. $[(90 \times 51.5) + (91 \times 11.2) + (92 \times 17.1) + (94 \times 17.4) + (96 \times 2.8)] \div 100$

or $[(90 \times 0.515) + (91 \times 0.112) + (92 \times 0.171) + (94 \times 0.174) + (96 \times 0.028)]$

Gets [1] method mark

If the 5 “numbers” are computed and added with only 1 error then [2] method marks can be awarded,

e.g. $4635 + 1019.2 + 1573.2 + 1635.6 + 268.8 = 9131.8$

or $46.35 + 10.19 + 15.73 + 16.36 + 2.69 = 91.32$ [3]

9

5 (a) hydrogen [1] acid [1]
metal [1] [3]

(b) (i) magnesium hydroxide + nitric acid \longrightarrow magnesium nitrate + water
LHS [1] RHS [1]
if e.g. LHS contains “2 nitric acid” or “two nitric acid”
and/or RHS includes “2 water” or “two water” this is **one** error
i.e. If numbers appear in the word equation the maximum mark is [1] [2]

(ii) white [1]

(iii) $H^+(aq) + OH^-(aq) \longrightarrow H_2O(l)$
LHS [1] RHS [1]
all state symbols correct [1] [3]

9

AVAILABLE
MARKS

6 (a)

Diagram	Number of shared pairs of electrons	Number of lone pairs of electrons	Name of molecule
A	3	2	nitrogen
B	1	3	hydrogen chloride
C	2	2	water or hydrogen sulfide
D	4	4	carbon dioxide
E	2	4	oxygen

[1] for each correct column $3 \times [1]$ [3]

(b) A, D, E – all three needed [1]

(c) all sharing correct [1]
 Correct total number of outer electrons i.e. 1 lone pair
and dot and cross diagram [1] second mark depends on first. [2]

6

7 (a)

Number of nitrogen atoms in formula	Number of hydrogen atoms in formula	Number of sulfur atoms in formula	Number of oxygen atoms in formula
2	8	1	4

[1]

(b) (i) 35 [1]
 132 [1] [2]

(ii) 6.6 g apply e.c.f. from 7b(i) i.e. credit if the 7b(ii) answer is $0.05 \times$ the ammonium sulfate value in 7(b)(i) [1]

(iii) 81.06% apply e.c.f. from 7b(ii) [2]
 Award a method mark for $(5.35 \div 6.6) \times 100$
 or for answer computed as 81% or 81.1%
 i.e. if the candidate used their 7(b)(ii) answer and gave a 7b(iii) answer which is “correct” to 2dp award [2] [2]

(c) it partially ionises/idea of forming some (hydroxide) ions [1]
 in water [1] for the ‘in water’ mark, reference to ionisation must be given [2]

8

AVAILABLE MARKS

			AVAILABLE MARKS
8	<p>(a) regular structure/arrangement [1] (unless wrongly qualified) (of) positive (metal) ions/cations (only) not protons [1] (and) delocalised electrons [1]</p>	[3]	
	<p>(b) electrons move [1] and carry charge [1] NB second mark is not dependent on first mark</p> <p>idea that layers can slide [1] without disrupting the bond [1]</p>	[4]	7
9	<p>(a) P – chlorine, Q – fluorine, R – iodine, S – bromine 4 correct = [2]; 2 or 3 correct = [1]</p>	[2]	
	<p>(b) (i) $2\text{NaI} + \text{Cl}_2 \longrightarrow 2\text{NaCl} + \text{I}_2$ LHS [1] RHS [1] balancing if all formulae correct [1]</p>	[3]	
	<p>(ii) $2\text{I}^- + \text{Cl}_2 \longrightarrow \text{I}_2 + 2\text{Cl}^-$ RHS [1] balancing if both formulae correct [1]</p>	[2]	
	<p>(c) solid [1] $\text{As}_2 + 2\text{Na} \longrightarrow 2\text{NaAs}$ [1] sodium astatide [1]</p>	[3]	10
Total			70