



Rewarding Learning

General Certificate of Secondary Education

Single Award Science Chemistry

Unit 2

Higher Tier

[GSA22]

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 Single Award Science**.

Candidates must:

- AO1** Demonstrate knowledge and understanding of scientific ideas, scientific techniques and procedures;
- AO2** Apply knowledge, skills and understanding of scientific ideas, scientific enquiry, techniques and procedures; and
- AO3** Analyse information and ideas to interpret and evaluate; make judgements and draw conclusions; 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. 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 'own figure rule' so that candidates are not penalised more than once for a computational error.

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

Tasks and questions requiring candidates to respond in extended writing are marked in terms of levels of response. In deciding which level of response to award, examiners should look for the 'best fit' bearing in mind that weakness in one area may be compensated for by strength in another. In deciding which mark within a particular level to award to any response, 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.
- **Intermediate performance:** Response which clearly merits inclusion in the level and should be awarded a mark at or near the middle 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 levels of response. The description for each level of response includes reference to the quality of written communication.

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

Level 1: Quality of written communication is basic.

Level 2: Quality of written communication is good.

Level 3: Quality of written communication is excellent.

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

Level 1 (Basic): 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.

Level 2 (Good): 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.

Level 3 (Excellent): 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.

General marking guidance for GCSE SA Science – 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: State **one** thing the teacher will see as soon as the sodium is added to water. [1]

MS: Sodium floats/moves on surface/bubbles [1]

- Any of these answers as a response would be acceptable. If two or more are given this is accepted.

2. Brackets in a response

- Normal parentheses used in a response means that a term is **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. Bolding in a response

- If part of a mark scheme response is in **bold** this is an essential word or phrase needed to gain credit for the response.

Example: (b) The teacher wants to test two different chemicals using a piece of nichrome wire. Describe fully how he should clean the wire between tests.

MS: Dip the wire in **concentrated** acid [1]

- To gain credit the candidate must use the word ‘concentrated’, writing ‘acid’ on its own would not gain this marking point.

4. Marking of spelling

- Where candidates give an incorrectly spelt response, credit can be given if the word is recognisable phonetically and cannot be confused with another word.

Example: Name the process, shown above, that is used to separate hydrocarbons. [1]

MS: Fractional distillation [1]

Response	Candidate Response	Marks awarded	Notes
1	fractional distillation	1	Correct response
2	fraction distillation	0	Incorrect response – no credit for 'fraction'
3	fractionle disillation	1	Correct response – phonetic spelling
4	frakonal distillasion	0	Correct response – phonetic spelling

5. 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 alumina is purified. [1]

MS: bauxite [1]

Response	Candidate Response	Marks awarded	Notes
1	bauxite (haematite)	0	Haematite is incorrect
2	bauxite (iron oxide)	0	Iron oxide is incorrect answer
3	alumina	0	Not the correct answer
4	aluminium oxide	0	Not the correct answer by itself
5	bauxite (aluminium oxide)	1	Aluminium oxide is a neutral answer

6. Marking of responses – 'Choose from'

- Where candidates choose extra responses from a list of prompts, additional responses **cannot** be ignored.
- Additional incorrect responses **cancel out** a correct response to the marking point to which they pertain.

Example: What name is given to these symbols?

Circle your answer.

security universal safety hazard [1]

MS: hazard [1]

Response	Candidate Response	Marks awarded	Notes
1	hazard	1	Correct response
2	universal and hazard	0	Universal is incorrect

7. 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	1	A single value within the accepted range
3	2	1	A single value within the accepted range
4	0.5	1	A single value within the accepted range
5	1.8	1	A single value within the accepted range
6	0–2	1	The accepted range
7	1–2	1	A range given within the accepted range
8	1–3	0	Range given outside the accepted range
9	0–3	0	Range given outside the accepted range
10	2.5	0	A single value not within the accepted range

8. 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.
- If the command word “**Identify**” is used, a candidate may provide either the name or symbol/formula. When the command word “**Name**” is used, only the correct name will be awarded the mark.

(b) Both name and formula provided

- 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 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

9. Balanced symbol equations

- A balanced symbol 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 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 the balancing.
- (ii) 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.

Example: Write a balanced symbol equation for the reaction of magnesium with sulfuric acid. [2]

MS: $\text{Mg} + \text{H}_2\text{SO}_4 \rightarrow \text{MgSO}_4 + \text{H}_2$ [2]

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	Both LHS and RHS of equation have incorrect formulae so no marks awarded.
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 first mark is awarded; the LHS has an incorrect formula so second mark is not awarded.
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 first mark awarded; the RHS has both formulae correct but balancing is wrong overall so second mark is not awarded.
4	$2\text{Mg} + 2\text{H}_2\text{SO}_4 \rightarrow 2\text{MgSO}_4 + 2\text{H}_2$	2	All formulae correct; multiple balancing numbers do not 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]

MS: $\text{CuCO}_3 + 2\text{HCl} \rightarrow \text{CuCl}_2 + \text{CO}_2 + \text{H}_2\text{O}$
correct formulae of reactants (LHS) [1]
correct formulae of products (RHS) [1]
correct balancing [1]

[3]

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.

10. 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 overall marks awarded should be in that band based on the standard of the 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]

- 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 only be given the lower mark in the band if there were multiple spelling, punctuation and grammar errors.

11. Marking calculations

- Any errors a candidate makes in a single calculation or between parts of a multipart calculation may be carried forward to calculate the final answer, thus giving partial credit for the calculation method. ECF may be used to indicate where an error is carried forward.
- Full marks can be awarded for a correct numerical answer to any calculation even if no working out is shown.
- Units are required where they are not provided at the end of an answer line.

12. 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 listing.

13. 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.

14. Marking diagrams

- Diagrams of 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 mark being awarded to each label of a recognisable piece of apparatus in an assembled diagram.
- **No labels = no marks.**
- In some diagrams a combination of pieces of apparatus are 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)	As you move down Group 1 melting point decreases Statement must be a full trend i.e reference both Group 1 and melting point Accept 'from lithium to caesium' as an alternative to 'going down Group 1' Accept the converse statement [1]	3
	(b)	The boiling points decrease more rapidly/by more Do not accept 'boiling points are higher'– must reference the trend [1]	
	(c)	140–200 °C [1]	
2	(a)	All points plotted correctly [2] (5 points plotted correctly [1]) smooth curve drawn [1] (Do not accept line drawn using a ruler) Ignore curve extrapolated to the origin [3]	6
	(b)	As the temperature increases so does the mass of solid dissolved [1] (accept converse statement) until 40 °C/until 180 g is dissolved and then the mass dissolved remains constant [1] To award the second mark a figure from the graph must be quoted [2]	
	(c)	Water freezes at 0 °C/too difficult to get temperature of 0 °C/water is a solid (ice) at 0 °C [1]	

- 3 (a) Fractional distillation
(Both terms needed to gain [1]) [1]
- (b) Boiling points [1]
- (c) X petrol/gasoline [1]
Y bitumen [1] [2]
- (d)
$$\begin{array}{c} \text{H} \\ | \\ \text{H} - \text{C} - \text{H} \\ | \\ \text{H} \end{array}$$
 [1]
- (e) Indicative content
- carbon dioxide
 - water
 - **increasing** levels of carbon dioxide
 - heat from the sun
 - heat gets trapped
 - this causes an increase in temperature
- Any **two** from:
- ice caps melt
 - sea levels rise
 - increased flooding
 - climate change
 - more extreme weather
 - spread of tropical diseases
- } only 2 of these points can gain credit

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe Global warming using at least seven of the points above, in a logical sequence. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates use some appropriate specialist terms to describe Global warming using four to six of the points above, in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates describe Global warming using one to three of the above points. However, these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and have made limited use of specialist terms. The form and style are of a limited standard.	[1]–[2]
D	Response not worthy of credit.	[0]

[6]

AVAILABLE
MARKS

11

4	(a) Mercury	[1]	3
	(b) Iron	[1]	
	(c) Iron	[1]	
5	(a) Caffeine contains 4 elements/more than one element [1] (chemically) joined [1]	[2]	5
	(b) (i) Coffee	[1]	
	(ii) Decaffeinated coffee	[1]	
	(iii) 3	[1]	
6	(a) Mobile phase	[1]	6
	(b) So that the baseline does not run into the solvent and affect the results (Accept a converse statement about line drawn in ink)	[1]	
	(c) X as there is only one colour in the chromatogram/only one spot present (no credit given for ' X ' without explanation)	[1]	
	(d) 5/9 [1] (accept 4.8/9 – the reading from the centre of the spot) 0.5556 [1] (ECF 0.53333) 0.6 [1] (ECF 0.5)	[3]	
7	(a) Alkaline earth metals [1] (Do not accept Alkali earth metals) halogens [1]	[2]	7
	(b) (i) The number of protons (in the nucleus of an atom) (Penalise reference to electrons)	[1]	
	(ii) (As the atomic number) increases the density (of the element) increases (Accept converse statement)	[1]	
	(iii) 2.8.8 drawn correctly (Penalise if electrons are drawn in the nucleus)	[1]	
	(iv) Noble gases all have a full outside shell of electrons	[1]	
	(v) 1/1840 or 1/2000 or zero/negligible	[1]	

			AVAILABLE MARKS
8	(a) (i) 40 cm ³	[1]	
	(ii) 110–112 s	[1]	
	(iii) 40/110 = 0.36 (allow ECF from (i) and (ii))	[1]	
	(b) Rate increases [1] Any two from: • more reactant particles [1] • more successful collisions [1] • in a given period of time/per second [1]	[3]	
	(c) aq s aq g (any two correct [1])	[2]	
9	(d) A catalyst speeds up/alters the rate of a reaction [1] without being used up/without taking part in the reaction [1]	[2]	10
	(a) Two	[1]	5
	(b) Covalent [1] each hydrogen shares 1 electron with oxygen/oxygen shares one electron with each hydrogen [1] two hydrogen atoms are needed for each oxygen atom [1]	[3]	
	(c) Any named diatomic element , e.g. hydrogen	[1]	
	(a) (i) The liquid that conducts electricity/the compound that is decomposed by electricity	[1]	
10	(ii) Bauxite	[1]	
	(b) The carbon reacts with the oxygen [1] and wears away [1]	[2]	4
Total			60

