



**General Certificate of Secondary Education
2022–2023**

**Single Award Science
Chemistry**

Unit 2
Higher Tier

[GSA22]

MONDAY 22 MAY 2023, MORNING

**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.

1 (a) Indicative Content:

- chromatography
- use filter/chromatography paper
- draw baseline in pencil
- pencil does not dissolve in the solvent
- add food colouring to baseline
- place the paper in beaker of water/solvent
- solvent not above pencil line/baseline/food colouring
- prevents the food colouring dissolving in the solvent
- allow solvent to move up paper/food colouring to separate
- take the paper out before the solvent reaches the top/mark the solvent front

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe chromatography using six to ten 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 chromatography using four to five 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 chromatography 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	Not worthy of credit.	[0]

[6]

(b) (i) Two spots drawn in correct positions [1]

(ii) Blue [1]

AVAILABLE
MARKS

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2 (a) A	[1]	AVAILABLE MARKS
(b) Fractional distillation	[1]	
(c) Any three from: <ul style="list-style-type: none"> • Crude oil is heated • Gases rise (the fractionating column)/ evaporates to form a gas • Different fractions have different boiling points • Condense at different levels 	[3]	
(d) (i) Alkanes	[1]	
(ii) $ \begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{H} - \text{C} - \text{C} - \text{H} \\ \quad \\ \text{H} \quad \text{H} \end{array} $	[1]	
(iii) Carbon dioxide [1] water [1] either order	[2]	
(e) (i) $77.0 + 12.5 + 5.5 + 3.0 + 0.5 + 0.25 + 0.05 = 98.8$ [1] $100 - 98.8 = 1.2$ [1]	[2]	
(ii) Carbon dioxide	[1]	
3 (a) The <u>temperature</u> at which a liquid changes into a gas	[1]	
(b) (i) Ethanol	[1]	
(ii) Ethanol	[1]	
(iii) Gas	[1]	
(c) Changes directly from a solid into a gas or vice versa	[1]	
(d) (i) Covalent	[1]	
(ii) A <u>pair</u> of electrons not involved in bonding	[1]	7

- 4 (a) (i) Groups/periods/separated metals and non-metals [1]
(ii) Mass [1]
(b) (i) Halogens [1]
(ii) As atomic number increases the melting point increases [1]
(iii) 85–125 °C [1]
(c) (i)
- | Particle | Number in atom | Relative Charge |
|----------|----------------|-----------------|
| proton | 9 | +1 |
| neutron | 10 | 0 |
| electron | 9 | –1 |
- 4 correct answers [2] 2 or 3 correct answers [1] [2]
(ii) Fluorine gains electrons [1] **one** electron [1] [2]
5 (a) 1×10^{-9} m [1]
(b) It can change colour [1] when there is a change in light conditions [1] [2]
(c) Graphene [1]
(d) Any **two** from:
 - not widely researched so not all risks evident yet
 - could penetrate body cells/damage body cells
 - issues disposing safely
[2]
6 (a) (i) 6 points correct [2] 5 points correct [1]
line of best fit [1] [3]
(ii) As time increases volume of gas increases [1]
until 80 s/45 cm³ and then no further increase [1] [2]
(iii) $18.5 \div 20$ [1]
0.9 cm³/s [1] [2]
(iv) 25–45 cm³ [1]
(b) Any **three** from:
 - increased reacting particles
 - particles collide more often
 - more successful collisions
 - in a given time
[3]

AVAILABLE
MARKS

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7	(a) (i) A substance that changes the rate of a reaction [1] without being used up [1]	[2]	AVAILABLE MARKS
	(ii) (Addition) polymerisation	[1]	
(b)	$ \begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ n \quad \text{C} = \text{C} \\ \quad \\ \text{H} \quad \text{H} \end{array} $		
	Correct structure [1] n [1]	[2]	
(c)	Incineration, [1] produces CO ₂ /contributes to global warming [1] or landfill, [1] takes up space/running out of space [1]	[2]	7
Total			60