



**General Certificate of Secondary Education
2023–2024**

**Single Award Science
Chemistry**

Unit 2
Higher Tier

[GSA22]

WEDNESDAY 22 MAY 2024, 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.

			AVAILABLE MARKS	
1	(a)	(i) Nano-silver has antibacterial properties/kills bacteria [1] reduces odour in clothing [1]	[2]	6
		(ii) Provides better UV protection/better skin coverage	[1]	
		(iii) Nanoparticles can enter cells/may enter water supplies and cause damage	[1]	
	(b)	(i) Thermochromic	[1]	
		(ii) Turns (blue to) red when the bottle is too hot	[1]	
2	(a)	(i) Butane	[1]	8
		(ii) As the number of carbon atoms increase, the boiling point increases	[1]	
	(b)	(i) 4 points plotted correctly [2], (3 correct [1]), line of best fit [1]	[3]	
		(ii) 3500 (± 100)	[1]	
	(c)	Water [1] carbon dioxide [1] (either order)	[2]	

3 Indicative Content:

Safety:

- care using Bunsen burner/do not touch hot nichrome wire/wear gloves when handling acid/wear safety goggles

Flame Test:

- dip wire into (concentrated) acid and put into Bunsen flame
- until no change in the flame colour
- dip the wire into the sample
- place into a **blue** (Bunsen) flame
- clean the nichrome wire in between samples

Results:

- potassium – lilac flame
- calcium – (brick) red flame

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe the experiment, in a logical sequence and using six to eight of the above flame test points and must also include a result. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates must use some appropriate specialist terms throughout to describe the procedure, using four to five of the above points. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates describe the procedure using only one to three of the above points however these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms.	[1]–[2]
D	Not worthy of credit.	[0]

[6]

6

4 (a) B, E, A, C

(All 4 correct = [2], any two in correct order = [1])

[2]

(b) C

[1]

3

AVAILABLE
MARKS

5 (a)

Particle	Relative charge	Relative mass	Location
electron	-1	$\frac{1}{1840}$	shell/orbital
neutron	0	1	nucleus
proton	+1	1	nucleus

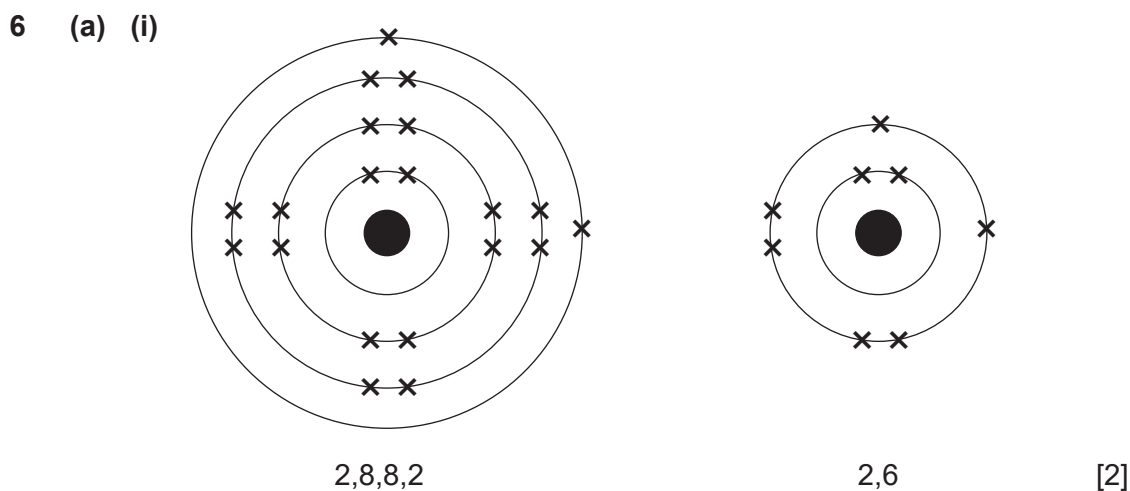
(4 correct [2], 3/2 correct [1]) [2]

(b)

Particle	Magnesium (Mg)	Fluorine (F)	Magnesium Fluoride (MgF ₂)
proton	12	9	30
electron	12	9	30
neutron	12	10	32

(All 6 correct [3], 4 or 5 correct [2], 2 or 3 correct [1]) [3]

- (c) (i) Alkaline earth metals [1]
(ii) 7 [1]



(ii) A calcium atom **loses 2e⁻** [1] and oxygen atom **gains 2e⁻** [1] [2]
(Allow ECF from (i))

(iii) O²⁻ [1]

- (b) (i) Covalent [1]
(ii) 4 [1]
(iii) Water, hydrogen chloride, methane (or other suitable) [1]

AVAILABLE MARKS

7

8

			AVAILABLE MARKS	
7	(a)	(i) Magnesium chloride	[1]	11
		(ii) Lit splint produces a (squeaky) pop	[1]	
		(iii) $2\text{H}_2 + \text{O}_2 \longrightarrow 2\text{H}_2\text{O}$ Balanced equation [1] H_2O [1]	[2]	
	(b)	(i) Measure the volume of gas produced [1] in a given time [1]	[2]	
		(ii) Higher temperatures produce faster reactions as particles have more energy [1] therefore moving faster [1] there will be more successful collisions [1]	[3]	
		(iii) Use a catalyst/use a more concentrated acid	[1]	
	(c)	Energy/heat is given out	[1]	

8 (a) (i) A compound/molecule that contains hydrogen and carbon [1] only [1] [2]

(ii) Fractional distillation [1]

(b) (i)

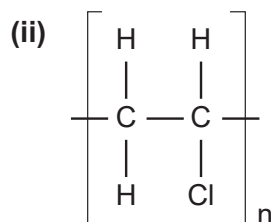
Hydrocarbon	Molecular formula	Structural formula
propane	C_3H_8 [1]	<pre> H H H H — C — C — C — H H H H </pre>
ethane [1]	C_2H_6	<pre> H H H — C — C — H H H </pre>
ethene	C_2H_4	<pre> H H C = C H H [1] </pre>

[3]

(ii) Gas [1]

(c) Greenhouse gases cause sea levels to rise/flooding/climate change [1]

(d) (i) (Addition) polymerisation [1]



[1] changes in bonding

[1] n placed at the right-hand side

[2]

Total

**AVAILABLE
MARKS**

11

60