Rewarding Learning

General Certificate of Secondary Education
2023–2024

Single Award Science
Chemistry

Unit 2

Higher Tier

[GSA22]

THURSDAY 22 FEBRUARY 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)**	Covalent	[1]	
		(ii)	HCl	[1]	
	(b)	**(i)**	3	[1]	
		(ii)	6	[1]	4
2	**(a)**	**(i)**	Lithium zinc copper	[1]	
		(ii)	Sodium	[1]	
	(b)	**(i)**	All points correct [2]/one plotting error [1] line of best fit [1]	[3]	
		(ii)	As time increases, volume of gas produced increases [1] at 3 mins/40 cm^3 gas, volume remains the same [1]	[2]	
		(iii)	Steeper gradient on graph/gas produced in less time	[1]	
		(iv)	Magnesium chloride	[1]	
		(v)	A squeaky pop	[1]	
		(vi)	Exothermic	[1]	11

AVAILABLE MARKS

3 Indicative content:

- protons, electrons, neutrons
- 3 protons
- 3 electrons
- 4 neutrons
- protons **and** neutrons contained in the nucleus
- electrons **orbit nucleus** in shells
- lithium **loses** electrons
- lithium loses **one** electron

Band	Response	Mark
A	Candidates must use appropriate specialist terms throughout to describe how a lithium ion is formed from a lithium atom using **seven to eight** 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 how a lithium ion is formed from a lithium atom 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 how a lithium ion is formed from a lithium atom 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] 6

4 (a) Phone records/internet logs/email messages [1]

(b) (i) Tiny pieces or fragments of evidence [1]

(ii) Hair [1]

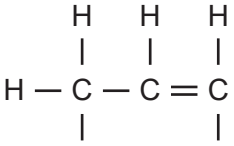
(iii) 100 [1]

(iv) Speeds up investigation/saves time/provides conclusive evidence in court [1]

(v) Gold nanoparticles have a lower melting point/dark red in colour [1]

(c) (i) Layer of carbon/graphite [1] one atom thick [1] [2]

(ii) Solar cells/batteries [1] 9

			AVAILABLE MARKS
5	**(a)**	Any **three** from: • draw a pencil line 1 cm from the bottom of the chromatography paper • place a small dot of black ink onto the pencil line • place the paper in a beaker with a small amount of solvent at the bottom • leave for a few minutes so that the solvent travels up the paper [3]	
	(b)	Stationary (phase) [1]	
	(c)	**(i)** **Y** [1]	
		(ii) 7.9 ÷ 10.5 [1] = 0.75 [1] = 0.8 (1dp) [1] [3]	8
6	**(a)**	**(i)** Gases [1]	
		(ii) Propane [1]	
		(iii) Increases [1]	
		(iv) In the range 30 – 45 °C [1]	
	(b)	 C_2H_4, butene [3]	
	(c)	$2C_3H_6$ + **9**O_2 [1] ⟶ **6**CO_2 + **6**H_2O [1] [2]	
	(d)	**(i)** (Addition) polymerisation [1]	
		(ii) C=C bond breaks [1] many propene/small molecules join together to form a long chain [1] [2]	12

				AVAILABLE MARKS
7	(a)	(i)	Anode and cathode correctly labelled [1]	
		(ii)	Inert [1] good conductor [1] [2]	
	(b)		Electrolyte [1]	
	(c)	(i)	Must be molten so that ions/charged particles [1] are free to move/carry a current/carry a charge [1] [2]	
		(ii)	Saves natural resources/saves energy/saves waste [1]	
		(iii)	$2O^{2-}$ [1] – $4e^{-}$ [1] $\longrightarrow$ O_2 [2]	
		(iv)	Anode reacts with oxygen (to form carbon dioxide) and it wears away [1]	10
			Total	**60**