

New
Specification



Rewarding Learning

**General Certificate of Secondary Education
2018**

GCSE Chemistry

Unit 1

Higher Tier

[GCM12]

WEDNESDAY 13 JUNE, 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 Chemistry. Candidates must:

- AO1** Demonstrate knowledge and understanding of:
- scientific ideas;
 - scientific techniques and procedures.
- AO2** Apply knowledge and understanding of and develop skills in:
- scientific ideas;
 - scientific enquiry, techniques and procedures.
- AO3** Analyse scientific 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. The exception to this for GCSE Chemistry 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.

1 (a) 1–100 nm [1]

(b) (i) giant covalent structure [1]
covalent bonds between carbon atoms [1]
weak forces between layers/van der Waals' forces between layers [1] [3]

(ii) conducts electricity/high melting point/high boiling point/soft/brittle [1]

(c) $\begin{array}{c} \cdot\cdot \\ \cdot\cdot \\ \times \\ \times \\ \cdot \\ \cdot \end{array} \text{O} \begin{array}{c} \times \\ \times \\ \times \\ \times \\ \cdot \\ \cdot \end{array} \text{C} \begin{array}{c} \times \\ \times \\ \times \\ \times \\ \cdot \\ \cdot \end{array} \text{O} \begin{array}{c} \cdot\cdot \\ \cdot\cdot \\ \cdot\cdot \\ \cdot\cdot \end{array}$ [1]

(d) (i)

Subatomic particle	Number of particles
proton	47
electron	47
neutron	61

 [1]

(ii) 17 protons and 20 neutrons in the nucleus [1]
electrons arranged 2, 8, 8 [1]
charge of $-1-$ [1] [3]

(e) (i) strong metallic bonding [1]
bonding requires substantial energy to break [1] [2]

(ii) giant ionic/ionic lattice [1]

(iii) ions can move [1] and (ions) can carry charge [1] [2]

AVAILABLE
MARKS

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- 2 (a) (i) $4\text{Li} + \text{O}_2 \rightarrow 2\text{Li}_2\text{O}$
 correct formulae of reactants [1]
 correct formula of product [1]
 correct balancing [1] [3]
- (ii) $\text{Li} \rightarrow \text{Li}^+ + \text{e}^-$
 [1] for $\text{Li} \rightarrow \text{Li}^+$
 [1] for e^- placed correctly with + or – as appropriate [2]
- (b) (i) oil removed [1]
 cut into small piece [1] [2]
- (ii) fizzing [1]
 colourless solution produced [1] [2]
- (iii) hydrogen [1]
- (c) (i) $\text{F}_2 + 2\text{e}^- \rightarrow 2\text{F}^-$
 [1] for F_2 and F^-
 [1] for e^- placed correctly with + or – as appropriate
 [1] for correct balancing [3]
- (ii) bromine is less reactive than fluorine/fluorine is more reactive than bromine [1]
 outer shell (electrons) further from nucleus in bromine [1]
 electron gained is less strongly attracted to nucleus [1] [3]

(iii)

Element	Name of group to which it belongs
lithium	alkali metals [1]
fluorine	halogens [1]

[2]

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AVAILABLE
MARKS

			AVAILABLE MARKS	
3	(a)	decreases	[1]	
	(b)	(i) $\text{H}_2\text{SO}_4 \rightarrow 2\text{H}^+ + \text{SO}_4^{2-}$ [1] [1]	[2]	
		(ii) 0–2	[1]	
	(c)	(i) $\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{CO}_2 + \text{H}_2\text{O}$ Correct formulae of reactants [1] Correct formulae of products [1] Correct balancing [1]	[3]	
		(ii) any two from: fizzing/bubbles/gas given off [1] colourless solution forms [1] solid disappears [1] heat released [1]	[2]	
	(d)	(i) pipette	[1]	
		(ii) pink [1] to colourless [1] wrong way round [1]	[2]	
		(iii) charcoal	[1]	
		(iv) solubility decreases (as temperature decreases)	[1]	
		(v) in a low temperature oven/in a desiccator/between 2 sheets of filter paper	[1]	15

- 4 (a) (i) coagulant [1]
- (ii) Process X = chlorination [1]
Process Y = desalination/distillation [1] [2]
- (iii) kills bacteria [1]
- (b) (i) (single) element or compound not mixed with any other substance [1]

(ii) **Indicative content**

- a pencil base line/origin is drawn on the chromatography paper near the bottom with a (concentrated) spot of the orange juice placed on the base line
- place in solvent (and run until solvent near top of paper)
- more than one spot indicates orange juice is not pure
- the distance moved by each spot is measured
- the distance to the solvent front is measured
- distance (is measured) from base line
- calculate the R_f value using $R_f = \frac{\text{distance moved by spot}}{\text{distance moved by solvent}}$

	Response	Mark
A	Candidates must use appropriate specialist terms to fully describe the chromatography experiment [5–7 indicative content points]. Relevant material is organised with a high degree of clarity and coherence. They must use excellent spelling, punctuation and grammar and the form and style are of a very high standard.	[5]–[6]
B	Candidates must use appropriate specialist terms to describe chromatography experiment [3–4 indicative content points]. Relevant material is organised with some clarity and coherence. They use good spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates describe the chromatography experiment in a limited way [at least 2 indicative content points]. The organisation of material may lack clarity and coherence. They use limited spelling, punctuation and grammar and they have limited use of specialist terms. The form and style are of limited standard.	[1]–[2]
D	Response not worthy of credit	[0]

[6]

- (c) (i) white [1]
- (ii) $\text{Ag}^+(\text{aq}) + \text{Cl}^-(\text{aq}) \rightarrow \text{AgCl}(\text{s})$
correct formulae of reactants [1]
correct formula of product [1]
correct state symbols [1] [3]
- (iii) add sodium hydroxide (solution) [1]
white ppt [1]
ppt remains/does not dissolve in excess sodium hydroxide [1] [3]

AVAILABLE
MARKS

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- 5 (a) % of oxygen = $\frac{13 \times 16}{286} [1] \times 100 = 72.7\% [1]$ [2]
- (b) mass of water = $4.90 - 2.65 = 2.25 \text{ g} [1]$
 moles of water = $\frac{2.25}{18} = 0.125 [1]$
 moles of $\text{Na}_2\text{CO}_3 = \frac{2.65}{106} = 0.025 [1]$
 $0.025 : 0.125 = 1:5$ so $x = 5 [1]$ [4]
- (c) moles $\text{Cl}_2 = \frac{28.4}{71} = 0.4 [1]$
 moles $\text{NaCl} = 0.4 \times 2 = 0.8 [1]$
 mass = $0.8 \times 58.5 = 46.8 \text{ g} [1]$ [3]
- (d) Moles of $\text{NaHCO}_3 = \frac{16.8}{84} = 0.2 [1]$
 Moles of $\text{MgSO}_4 = \frac{6}{120} = 0.05 [1]$
 Limiting reactant is $\text{MgSO}_4 [1]$
 Moles of $\text{Na}_2\text{SO}_4 = 0.05 [1]$
 Mass of $\text{Na}_2\text{SO}_4 = 0.05 \times 142 = 7.1 \text{ g} [1]$ [5]

Total

**AVAILABLE
MARKS**

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