



*Rewarding Learning*

**General Certificate of Secondary Education  
2025**

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**Chemistry**

Unit 2

Higher Tier

**[GCM22]**

**FRIDAY 13 JUNE, MORNING**

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**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.

Where one response is required to gain a mark, candidates will not gain credit if a correct response is given alongside one or more incorrect responses. This is referred to as listing.

1	(a) (i) water and oxygen	[1]	
	(ii) C as reaction is fastest/least time	[1]	
	(iii) manganese dioxide/manganese(IV) oxide	[1]	
	(iv) filter (and dry) [1] weigh [1] mass is unchanged/mass is 1 g [1]	[3]	
(b)	(i) 20–22 cm <sup>3</sup>	[1]	
	(ii) (gas volume) increases [1] at time 114–120 s (gas volume) reaches maximum/levels off [1]	[2]	
	(iii) particles have more energy/move faster[1] more successful collisions [1] in unit time/per second [1]	[3]	
(c)	(i) only one product	[1]	
	(ii) economic reasons/more sustainable/no waste	[1]	

**AVAILABLE  
MARKS**

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- 2 (a) decomposition of a liquid electrolyte using a direct current of electricity [1]
- (b) ions can move and carry charge [1]
- (c) anode [1]
- (d)  $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$   
 $\text{Cl}^-$  on left and  $\text{Cl}_2$  on right [1]  
 $+ \text{e}^-$  on right (or  $- \text{e}^-$  on left) [1]  
 correct balancing [1] [3]
- (e) green-yellow/green (gas) [1]
- (f) magnesium ions/ $\text{Mg}^{2+}$  gain two electrons [2]  
 (magnesium ions/ $\text{Mg}^{2+}$  gain electrons [1]) [2]
- (g) moles of magnesium chloride =  $\frac{0.38}{95} = 0.004$  [1]  
 moles of chlorine = 0.004 [1]  
 volume =  $0.004 \times 24000 = 96 \text{ (cm}^3\text{)}$  [1] [3]

AVAILABLE  
MARKS

12

- 3 (a) (i) any **two** from
- gradation in melting point/boiling point/physical property
  - consecutive members differ by a  $\text{CH}_2$
  - same general formula
  - all have an OH group/same functional group
- [2]

(ii)  $\text{C}_2\text{H}_5\text{OH}$  and  $\text{C}_3\text{H}_7\text{OH}$  [1]

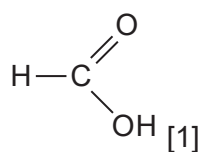
(iii)

	Structural formula	Name
1	$  \begin{array}{c}  \text{H} \quad \text{H} \quad \text{H} \\    \quad   \quad   \\  \text{H}-\text{C}-\text{C}-\text{C}-\text{OH} \\    \quad   \quad   \\  \text{H} \quad \text{H} \quad \text{H}  \end{array}  $	propan-1-ol
2	$  \begin{array}{c}  \text{H} \quad \text{H} \quad \text{H} \\    \quad   \quad   \\  \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\    \quad   \quad   \\  \text{H} \quad \text{OH} \quad \text{H}  \end{array}  $	propan-2-ol

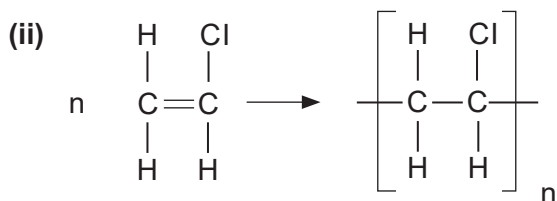
[1] per correct row [2]

(iv) a reactive group in a molecule [1]

(b) (i) structural formula:



name: methanoic acid [1] [2]



monomer structure [1]

polymer structure [1]

n in correct position on left and right [1] [3]

**(c) Indicative content**

- reaction of a fuel with oxygen
- producing oxides and releasing heat
- products are carbon dioxide and water
- carbon dioxide – use limewater
- changes from colourless to milky
- water – use anhydrous copper(II) sulfate
- changes from white to blue

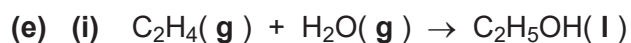
Band	Response	Mark
<b>A</b>	Candidates must use appropriate specialist terms including a minimum of 6 points of indicative content. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
<b>B</b>	Candidates must use appropriate specialist terms including a minimum of 4 points of indicative content. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
<b>C</b>	Candidates' brief and partial response includes 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]
<b>D</b>	A response not worthy of credit.	[0]

[6]

**(d) any three from:**

- warm
- no air/anaerobic
- in solution
- presence of yeast

[3]



[1]

**(ii)** ethene

[1]

**(iii)** addition

[1]

AVAILABLE  
MARKS

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- 4 (a) bonds broken =  $242 + 151 = 393$  [1]  
 bonds made =  $2 \times 208 = 416$  [1]  
 energy change =  $393 - 416 = -23$  [1] (kJ) [4]
- (b)  $\text{BrF}_3$  [1]
- (c)  $5\text{ICl} + 3\text{H}_2\text{O} \rightarrow 5\text{HCl} + \text{HIO}_3 + 2\text{I}_2$  [1]
- (d) (i) rates of forward reaction and reverse reaction are equal [1]  
 amounts of reactants and products remain constant [1] [2]
- (ii) heat is given out [1]
- (iii) yield increases [1]  
 position of equilibrium moves to the right [1]  
 to side of fewer gas moles/2 moles of gas on left and 1 on right [1] [3]
- (e) (i) exothermic as products have less energy than reactants/energy  
 change is negative [1]
- (ii) progress of reaction [1]
- (iii) B [1]

AVAILABLE MARKS
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- 5 (a) unreactive [1]
- (b) (i)  $\text{Cu}_2\text{O}$  [1]
- (ii) bauxite [1]
- (iii)
- | Metal     | Electrolysis | Chemical reduction |
|-----------|--------------|--------------------|
| Aluminium | ✓ [1]        |                    |
| Copper    |              | ✓ [1]              |
| Zinc      |              | ✓ [1]              |
- [3]
- (c) (i) A: coke [1]  
reducing agent: carbon monoxide [1] [2]
- (ii) coke burns to give carbon dioxide [1]  
carbon dioxide reacts with more coke [1] (to make reducing agent/CO) [2]
- (iii) haematite [1]
- (iv)  $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$   
correct formulae of reactants [1]  
correct formulae of products [1]  
correct balancing [1] [3]
- (v) limestone [1]
- (vi) C = slag/calcium silicate [1]  
E = hot air [1] [2]
- (d) (i)  $\text{Fe} + \text{CuSO}_4 \rightarrow \text{Cu} + \text{FeSO}_4$   
correct formulae of reactants or products [1]  
rest of equation correct [1] [2]
- (ii)  $\text{Fe} + \text{Cu}^{2+} \rightarrow \text{Cu} + \text{Fe}^{2+}$   
correct formulae of reactants or products [1]  
rest of equation correct [1] [2]
- (iii)  $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$   
 $\text{Cu}^{2+}$  on left and Cu on right [1]  
+  $\text{e}^-$  on left [1]  
correct balancing [1] [3]

AVAILABLE  
MARKS

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			AVAILABLE MARKS		
6	(a)	(i) A = burette [1] B = pipette [1] C = conical flask [1] D = white tile [1]	[4]		
		(ii) (safety) pipette filler/pi-pump	[1]		
		(iii) colourless to pink [2] wrong way round = [1]	[2]		
	(b)	(i) concentration of NaOH(aq) = $\frac{2}{40} = 0.05 \text{ (mol/dm}^3\text{)}$ [1]			
		moles of NaOH(aq) used = $\frac{33.0 \times 0.05}{1000} = 1.65 \times 10^{-3}$ [1]	[2]		
		(ii) moles of H <sub>3</sub> A = $\frac{1.65 \times 10^{-3}}{3} = 5.5 \times 10^{-4}$	[1]		
		(iii) concentration = $5.5 \times 10^{-4} \times 40 = 0.022 \text{ (mol/dm}^3\text{)}$	[1]		
		(iv) concentration = $0.022 \times 192 = 4.224 \text{ (g/dm}^3\text{)}$	[1]		12
	<b>Total</b>				<b>100</b>