



**General Certificate of Secondary Education  
2025**

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**Double Award Science: Chemistry**

**Unit C2**

**Higher Tier**

**[GDW52]**

**FRIDAY 13 JUNE, MORNING**

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**MARK  
SCHEME**

## **General Marking Instructions**

### **Introduction**

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

### **The Purpose of Mark Schemes**

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of students in schools and colleges.

The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

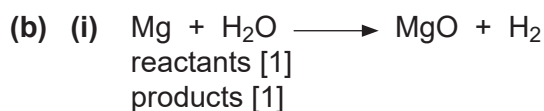
It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

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)**

| Metal     | Observation when heated in air |
|-----------|--------------------------------|
| iron      | orange sparks [1]              |
| magnesium | bright white light [1]         |
| copper    | glows red [1]                  |

[3]



[2]

(ii) white light [1] white solid [1]

[2]

(iii) insoluble

[1]

8

**2 (a)** hydrated [1] Iron(III) oxide [1]

[2]

**(b) (i)** drying agent / removes water from the air

[1]

(ii) oxygen/air [1] water has been boiled to remove oxygen [1]

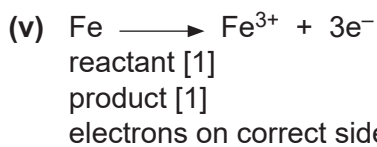
[2]

- (iii) prevents oxygen dissolving in water again

[1]

**(iv)** iron nail is coated in zinc [1] zinc is a more reactive metal and will corrode in the place of iron/layer stops oxygen and water reacting with metal underneath [1]

[2]



[3]

(c) Any **one** from:  
gain of hydrogen  
loss of oxygen  
gain of electrons

[1]

12

### 3 (a) Indicative points

*The name of the ore that contains aluminium oxide*

- bauxite

*Explain why aluminium oxide needs to be molten to conduct electricity*

- ions
- (free to) move and carry a charge

*Explain why cryolite is added*

- improves (electrical) conductivity
- lowers melting point/operating temperatures

*Explain why the graphite anodes need to be periodically replaced*

- carbon reacts with oxygen
- forms carbon dioxide
- corrodes/burns away

| Band | Response                                                                                                                                                                                                                                                 | Marks   |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| A    | Candidates must use appropriate specialist terms including a minimum of <b>5–8</b> points of indicative content. They use good spelling, punctuation and grammar and the form and style are of a high standard.                                          | [5]–[8] |
| B    | Candidates must use appropriate specialist terms including a minimum of <b>3–4</b> points of indicative content. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.                          | [3]–[4] |
| C    | Candidates brief and partial response includes a minimum of <b>1–2</b> 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] |
| D    | Response not worthy of credit.                                                                                                                                                                                                                           | [0]     |

[6]

(b) (i) positive electrode

[1]

(ii) bromine

[1]

AVAILABLE  
MARKS

8

|   |         |                                                                                                                                                                     | AVAILABLE MARKS |
|---|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| 4 | (a) (i) | Any <b>three</b> from:<br>same general formula<br>similar chemical properties<br>gradation in physical properties<br>(successive members) differ by CH <sub>2</sub> | [3]             |
|   | (ii)    | alcohols                                                                                                                                                            | [1]             |
|   | (b) (i) | a compound/molecule which consists of only [1]<br>carbon and hydrogen atoms [1]                                                                                     | [2]             |
|   | (ii)    | CO <sub>2</sub> [1] H <sub>2</sub> O [1]                                                                                                                            | [2]             |
|   | (iii)   | CH <sub>4</sub> + 3/2 O <sub>2</sub> → CO + 2H <sub>2</sub> O<br>multiples accepted                                                                                 | [3]             |
|   | (c) (i) | -COOH circled                                                                                                                                                       | [1]             |
|   | (ii)    | partially ionises in water                                                                                                                                          | [1]             |
|   | (iii)   | Any <b>two</b> from:<br>solid disappears<br>solution turns blue<br>effervescence<br>heat given off                                                                  | [2]             |
|   | (iv)    | copper(II) ethanoate                                                                                                                                                | [1]             |
|   |         |                                                                                                                                                                     | 16              |
| 5 | (a) (i) | (solid crystals that have) water bonded into the crystal structure                                                                                                  | [1]             |
|   | (ii)    | 45g<br>Moles in solution = 0.25 × 2 = 0.5 [1]<br>Mr of C <sub>2</sub> H <sub>2</sub> O <sub>4</sub> = 90 [1]<br>Mass = 90 × 0.5 [1]                                 | [3]             |
|   | (b) (i) | mass of desired product = 2 × 17 = 34 [1]<br>mass of all products = 181 [1]<br>atom economy = 34/181 × 100 = 18.78% [1]                                             | [3]             |
|   | (ii)    | atom economy is too low/is not cost effective/<br>creates too much waste                                                                                            | [1]             |
|   |         |                                                                                                                                                                     | 8               |

|   |     |                        |                                                                                                                                                                                                                                   |                                                             |                 |
|---|-----|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|-----------------|
| 6 | (a) |                        |                                                                                                                                                                                                                                   |                                                             | AVAILABLE MARKS |
|   |     | <b>Gas</b>             | <b>Formula</b>                                                                                                                                                                                                                    | <b>Use</b>                                                  |                 |
|   |     | nitrogen               | <b>N<sub>2</sub></b> [1]                                                                                                                                                                                                          | food packaging                                              |                 |
|   |     | <b>hydrogen</b><br>[1] | H <sub>2</sub>                                                                                                                                                                                                                    | <b>weather balloons / hardening of oil / clean fuel</b> [1] |                 |
|   |     | carbon dioxide         | <b>CO<sub>2</sub></b> [1]                                                                                                                                                                                                         | fire extinguisher                                           | [4]             |
|   | (b) | (i)                    | thistle funnel                                                                                                                                                                                                                    |                                                             | [1]             |
|   |     | (ii)                   | magnesium                                                                                                                                                                                                                         |                                                             | [1]             |
|   |     | (iii)                  | 2H <sub>2</sub> + O <sub>2</sub> —→ 2H <sub>2</sub> O<br>reactants [1]<br>product [1]<br>balancing [1]                                                                                                                            |                                                             | [3]             |
|   |     | (iv)                   | lit splint [1] pop [1]                                                                                                                                                                                                            |                                                             | [2]             |
|   |     |                        |                                                                                                                                                                                                                                   |                                                             | 11              |
| 7 | (a) | (i)                    | rate = 1/19 [1]<br>= 0.053 [1]                                                                                                                                                                                                    |                                                             | [2]             |
|   |     | (ii)                   | start at origin [1]<br>curve displaced to the right [1]<br>maximum mass reached is 4g [1]                                                                                                                                         |                                                             | [3]             |
|   |     | (iii)                  | Effect:<br>decreases the rate of reaction [1]<br><br>Explanation:<br>particles have less energy / fewer particles have energy greater than activation energy / particles are moving slower [1]<br>fewer successful collisions [1] |                                                             | [3]             |
|   |     | (b)                    | (i)                                                                                                                                                                                                                               | manganese(IV) oxide                                         | [1]             |
|   |     | (ii)                   | Effect:<br>increases the rate (of decomposition of hydrogen peroxide / formation of oxygen) [1]<br><br>Explanation:<br>provides an alternative reaction pathway [1]<br>with a lower activation energy [1]                         |                                                             | [3]             |
|   |     |                        |                                                                                                                                                                                                                                   |                                                             | 12              |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|
| <p><b>8 (a)</b> <math>2\text{SO}_2 + \text{O}_2 \rightleftharpoons 2\text{SO}_3</math><br/> correct equation and balancing [1]<br/> correct arrow [1]</p> <p><b>(b)</b> forward reaction and reverse reaction are the same [1]<br/> reactants and products remain constant [1]</p> <p><b>(c)</b> Any <b>one</b> from:<br/> change the direction<br/> alters the amount of reactants<br/> alters the amount of products</p> <p><b>Total</b></p> | AVAILABLE<br>MARKS                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                | <div>[2]</div> <div>[2]</div> <div>[1]</div> <div>5</div> |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                | 80                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                           |