



**General Certificate of Secondary Education
2023**

Double Award Science: Chemistry

Unit C2

Higher Tier

[GDW52]

TUESDAY 13 JUNE, MORNING

**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.

| | | |
|---|-----|--------------------|
| 1 (a) (i) hydrogen | [1] | AVAILABLE MARKS |
| (ii) boiling tube/test tube | [1] | |
| (iii) any three from: idea of sinking and rising calcium disappears colourless solution formed white solid formed heat released | [3] | |
| (iv) no reaction/very slow reaction/slower | [1] | |
| (b) (i) $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$ | [2] | |
| (ii) red-brown | [1] | |
| (iii) most reactive: zinc nickel tin least reactive: copper | [1] | |
| | | 10 |

- 2 (a) $2\text{Al} + \text{Fe}_2\text{O}_3 \rightarrow 2\text{Fe} + \text{Al}_2\text{O}_3$
 correct formulae of products [1]
 correct balancing [1] [2]
- (b) aluminium is more reactive than iron [1]
- (c) **Indicative content**
State what is meant by activation energy
 • minimum energy required for a reaction to occur
State and explain the type of energy change happening
 • exothermic
 • energy of products lower than energy of reactants
Explain, in terms of electrons, why this reaction is described as a redox reaction
 • iron **ions** gain (three) electrons
 • reduction is gain of electrons
 • aluminium atoms lose (three) electrons
 • oxidation is the loss of electrons
 • redox is oxidation and reduction occurring in the same reaction

| Band | Response | Marks |
|----------|--|---------|
| A | 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 | 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] |
| C | 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] |
| D | Response not worthy of credit | [0] |

[6]

AVAILABLE
MARKS

9

| | | | |
|-----------|-------------------------|---|-----|
| 3 (a) (i) | Substance | Name of particle which can move and carry the charge | |
| | solid aluminium | delocalised electrons | |
| | molten lead(II) bromide | ions [1] | [1] |

(ii) decompose [1]

(b) (i) any **two** from:
conductor of electricity
inert/unreactive
high melting point [2]

| | | | | | |
|------|--------------------------|-------------------------------|---------------------|-------------------------------|-----|
| (ii) | Anode | | Cathode | | |
| | Observations | Name of product formed | Observations | Name of product formed | |
| | red-brown [1] gas [1] | bromine [1] | Grey liquid formed | lead [1] | [4] |

(iii) $\text{Pb}^{2+} + 2\text{e}^{-} \rightarrow \text{Pb}$ [2]

4 (a) (i) but-2-ene [1]

(ii) $\text{C}_3\text{H}_6\text{O}_2/\text{CH}_3\text{CH}_2\text{COOH}/\text{C}_2\text{H}_5\text{COOH}$ [1]

(iii) $\text{C}_n\text{H}_{2n+2}$ [1]

(iv) liquid [1]

(v) E [1]

(b) (i)

$$\begin{array}{c} \text{H} & \text{H} & \text{H} \\ | & | & | \\ \text{H}-\text{C} & = & \text{C}-\text{C}-\text{H} \\ & & | \\ & & \text{H} \end{array}$$

[1]

(ii) equation: $\text{C}_2\text{H}_4 + \text{H}_2 \rightarrow \text{C}_2\text{H}_6$ [2]
name of product: ethane [1] [3]

(iii)

$$n \begin{array}{c} \text{Cl} & \text{H} \\ | & | \\ \text{C} & = & \text{C} \\ | & | \\ \text{H} & \text{H} \end{array} \longrightarrow \left[\begin{array}{cc} \text{Cl} & \text{H} \\ | & | \\ -\text{C} & - & \text{C}- \\ | & | \\ \text{H} & \text{H} \end{array} \right]_n$$

correct structure of polymer [1]
n before monomer and after polymer [1] [2]

(c) (i) steam [1]

(ii) fermentation [1]

(iii) CO_2 and H_2O (both required for mark) [1]

AVAILABLE
MARKS

10

14

| 5 | (a) | contains water of crystallisation | [1] | 7 | | | | | | | |
|-----------|---|---|-------|----|-----------------------------|-----------------------|-----------|-----------------|-----------------|--------|---|
| | (b) | heat and weight [1] repeat (until two mass measurement are the same) [1] | [2] | | | | | | | | |
| | (c) (i) | 28.6 – 10.6 = 18(g) | [1] | | | | | | | | |
| | (ii) | $\frac{18}{18} = 1$ | [1] | | | | | | | | |
| | (iii) | $\frac{10.6}{106} = 0.1$ | [1] | | | | | | | | |
| | (iv) | x = 10 | [1] | | | | | | | | |
| 6 | (a) (i) | K = delivery tube [1] L = gas jar [1] | [2] | 11 | | | | | | | |
| | (ii) | 2H ₂ O ₂ → 2H ₂ O + O ₂ correct formula of reactant [1] correct formulae of products [1] correct balancing [1] | [3] | | | | | | | | |
| | (iii) | manganese(IV) oxide/manganese dioxide | [1] | | | | | | | | |
| | (iv) | glowing splint relights | [1] | | | | | | | | |
| | (b) | <table border="1"><thead><tr><th>Metal</th><th>Observations during heating</th><th>Appearance of product</th></tr></thead><tbody><tr><td>Magnesium</td><td>white flame [1]</td><td>white solid [1]</td></tr><tr><td>Copper</td><td>glows red/orange/ blue-green flame [1]</td><td>black solid [1]</td></tr></tbody></table> | Metal | | Observations during heating | Appearance of product | Magnesium | white flame [1] | white solid [1] | Copper | glows red/orange/ blue-green flame [1] |
| Metal | Observations during heating | Appearance of product | | | | | | | | | |
| Magnesium | white flame [1] | white solid [1] | | | | | | | | | |
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| | | | | |
|-------|---------|--|-----|--------------------|
| 7 | (a) (i) | limestone | [1] | AVAILABLE MARKS |
| | (ii) | haematite | [1] | |
| | (b) | hot air | [1] | |
| | (c) (i) | reducing agent | [1] | |
| | (ii) | CO ₂ + C → 2CO correct formulae of reactants [1] correct formula of product [1] correct balancing [1] | [3] | |
| | (d) | B = (molten) slag [1] C = (molten) iron [1] | [2] | |
| | (e) | CaO + SiO ₂ → CaSiO ₃ correct formulae of reactants [1] correct formula of product [1] | [2] | |
| | | | | |
| | | | | |
| | | | | |
| 8 | (a) (i) | energy taken in to break bonds = 4(412) + (158) = 1806 [1] energy released forming bonds = 3(412) + (452) + (565) = 2253 [1] energy change = 1806 – 2253 = – [1] 447 [1] | [4] | 11 |
| | (ii) | negative so exothermic | [1] | |
| | (b) | energy required to break the bonds in H ₂ and F ₂ [1] is less than [1] energy released when forming bonds in HF [1] | [3] | |
| | | | | |
| | | | | |
| Total | | | | 80 |