



**General Certificate of Secondary Education
2019–2020**

**Double Award Science
Chemistry**

Unit C1

Higher Tier

[GDW22]

THURSDAY 27 FEBRUARY 2020, 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 Double Award Science.

Candidates must:

- AO1** Demonstrate knowledge and understanding of:
- scientific ideas; and
 - scientific techniques and procedures;
- AO2** Apply knowledge and understanding of and develop skills in:
- scientific ideas; and
 - scientific enquiry, techniques and procedures; and
- AO3** Analyse scientific information and ideas to:
- interpret and evaluate;
 - make judgements and draw conclusions; and
 - 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 Double Award Science 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) (i) Idea of having too much nitrogen/N [1]
- (ii) Idea that:
 a formulation is a **mixture** designed as a **useful** product [1]
 a formulation has **carefully measured** quantities/proportions [1]
 a formulation is made to ensure the product has the required/
 desirable **properties** [1] [3]
- (b) Any **two** ideas from:
 better skin coverage/spread easily/cover a large area
 more effective protection from the Sun's **ultraviolet rays** [1]
 transparent [1] allow idea of not being white
 Max 2 × [1] [2]
- (c) (i) A – solvent front [1]
 B – base line/origin [1] [2]
- (ii) Idea that:
 Substances/dyes move at different rates faster/further [1]
 Some dyes more soluble in mobile phase or solvent/some dyes cling
 more to the paper [1] [2]

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2 (a)

Atom or ion	Mass number	Number of protons	Number of electrons	Number of neutrons
C	13	6	6	7
Br ⁻	79	35	36	44
Ga ³⁺	70	31	28	39

[1] per column
 (4 × [1])

[4]

- (b) 24.32 [2]
- One method mark can be awarded for:
 (24 × 79) + (25 × 10) + (26 × 11) ÷ 100 (if answer is wrong/not computed)
 If work is shown computed as 24.32 but answer given as 24.3 award [1]
 There are no marks for an answer other than 24.32 which has no correct
 computation step shown

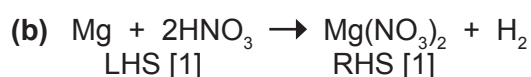
6

3 (a)

Metal compound	Acid	Name of salt	Formula of salt	Formula of cation in salt	Formula of anion in salt
aluminium oxide	hydrochloric acid	aluminium chloride	AlCl_3	Al^{3+}	Cl^-
copper(II) oxide/ copper(II) hydroxide/ copper(II) carbonate	nitric acid	copper(II) nitrate	$\text{Cu}(\text{NO}_3)_2$	Cu^{2+}	NO_3^-
potassium hydroxide	hydrochloric acid	potassium chloride	KCl	K^+	Cl^-
sodium carbonate	sulfuric acid	sodium sulfate	Na_2SO_4	Na^+	SO_4^{2-}

each row [1]

[4]



correct balancing if all formulae correct [1]

[3]

(c) The acid in beaker D has the lowest pH

[1]

(d) (i) idea of being completely ionised [1] in water [1]
 for the 'in water' mark, reference to ionisation must be given

[2]

(ii) idea of there being a small amount of solute (e.g. sodium hydroxide)
 in a large amount of solvent (e.g. water)

[1]

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4 (a) clear idea that it takes substantial **energy** to **break** the (strong ionic) bonds/electrostatic forces of attraction [1] i.e. **not** just that the bonds are strong
 when solid the **ions** are not free to move/when molten the **ions** can move [1]
 when solid the **ions** can't carry the charge/
 when molten the **ions** can carry the charge [1]

[3]

(b) clear idea that it takes little energy to break the weak van der Waals' forces [1] between the molecules [1]

[2]

5

5 Indicative points

Colour and physical state of chlorine, bromine and iodine

- chlorine is a green/yellow-green/green-yellow gas
- bromine is a red-brown/brown-red liquid (both needed)
- iodine is a grey-black/black-grey solid (both needed)

If none of these 3 IPs are gained award 1 IP if all 3 states are correct or all 3 colours correct

Observations when iodine is heated in a boiling tube

- it sublimes/changes from a solid to a vapour
- a violet/purple vapour/gas
- idea that (grey-black) solid/crystals appear on the sides of the boiling tube

Test for chlorine

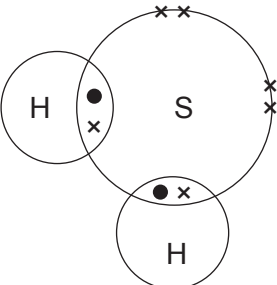
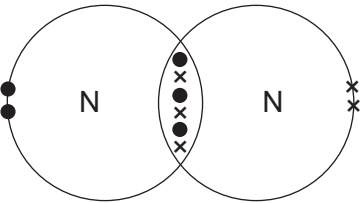
- **damp** universal indicator paper/**damp** blue litmus paper
- turns red
- then bleaches/turns white

Band	Response	Mark
A	Candidates must use appropriate scientific terms throughout to describe the chemistry of the halogens in a logical sequence, using 7–9 of the points in the indicative content. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates use 4–6 points from the indicative content to describe the chemistry of the halogens using some scientific terms and some logical sequencing. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates use 2–3 of the points from the indicative content to describe the chemistry of the halogens. They use limited spelling, punctuation and grammar and make little use of scientific terms. The form and style are of a limited standard.	[1]–[2]
D	0–1 points. Response not worthy of credit.	[0]

[6]

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6 (a) $\text{Ba}(\text{OH})_2 = 171$ [1] $\text{BaSO}_4 = 233$ [1] [2] (b) (i) 5.22 g [1] (ii) 0.054 [1] (c) 34.1% [2] A method mark can be awarded for: $\frac{71}{208} \times 100$ or for a computation with one error i.e. $\frac{35.5}{208} \times 100 = 17.1\%$ (d) (i) 5.99 g [3] Up to 2 method marks can be awarded – e.c.f. should be applied moles of $\text{Ba}(\text{NO}_3)_2 = 17.00 \div 261 = 0.0651$ [1] moles of $\text{NO}_2 = 0.0651 \times 2 = 0.1302$ [1] mass of $\text{NO}_2 = 0.1302 \times 46 = 5.99 \text{ g}$ [1] (ii) 65.9% apply e.c.f. [2] Method mark for % yield = $3.95 \div 5.99 \times 100$ [1] apply e.c.f.	11
7 (a) K = 2, 8, 8, 1 [1] O [1] [2] (b) correct direction of electron transfer [1] magnesium atom loses/transfers two electrons [1] chlorine atom gains one electron [1] idea that two chlorine atoms react with one magnesium atom [1] [4] (c)  correct sharing and correct total number of electrons [1] dot and cross [1] either lone pair labelled [1] [3] (d)  correct sharing [1] correct total number of electrons [1] [2]	11

- 8 (a) idea of changing (from shiny) to dull [1]
(reaction with) oxygen/air [1]
store in oil [1] [3]
- (b) (i) colourless [1] to yellow/orange/brown [1] [2]
- (ii) $\text{Cl}_2 + 2\text{KBr} \rightarrow 2\text{KCl} + \text{Br}_2$
LHS [1] RHS [1]
correct balancing if all formulae correct [1] [3]
- (iii) $\text{Cl}_2 \rightarrow 2\text{Cl}^- - 2\text{e}^-$ **or** $\text{Cl}_2 + 2\text{e}^- \rightarrow 2\text{Cl}^-$
One mark is for having $\text{Cl}_2 \rightarrow \text{Cl}^- - \text{e}^-$ **or** $\text{Cl}_2 + \text{e}^- \rightarrow \text{Cl}^-$
balancing, if all species correct [1] NB accept e for e^-
For $\text{Cl} + \text{e}^- \rightarrow \text{Cl}^-$
or $\text{Cl} \rightarrow \text{Cl}^- - \text{e}^-$
Award [1] [2]

Total

**AVAILABLE
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70