General Certificate of Secondary Education
2018–2019

Double Award Science: Chemistry

Unit C1

Higher Tier

[GDW22]

THURSDAY 28 FEBRUARY 2019, 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)**

Ion	Atomic number	Number of electrons
K⁺	19	18
Ca²⁺	**20**	**18**
Cu²⁺	29	27

[1] per row 3 × [1]   [3]

(ii) cation   [1]

(iii) **nichrome** wire [1]
dipped in **concentrated hydrochloric acid** [1]
(into the sample) and into a **blue/roaring** Bunsen burner flame [1]   [3]
If nothing implicit about use of sample – max [2]

(iv) brick red   [1]

(b) **(i)** $Ca(NO_3)_2$ [1]

(ii) substance consisting of two or more elements [1]
which are (chemically) combined [1]   accept joined or bonded   [2]
don't allow wrongly qualified, e.g. 'ionic'

(iii) nitric acid [1]
calcium oxide/calcium hydroxide/calcium carbonate/calcium
hydrogencarbonate [1]   [2]   13

2 **(a)** A salt is a compound [1] formed when (some or all of) the H^+ ions in an acid [1]
are replaced with metal ions (or ammonium ions) [1] [3]

(b) **Indicative content:**
- salt = magnesium chloride
- other product = carbon dioxide
- other product = water
- hydrochloric acid = **colourless** solution   accept **colourless** liquid
- magnesium carbonate = white (solid)   unless wrongly qualified
- bubbles/fizzes/effervescence/gas given off
- heat released/produced – Idea of temperature rise   **NOT** exothermic
- solid/magnesium carbonate disappears/dissolves
- colourless solution formed

Band	Response	Mark
A	Candidates make correct reference to **7–9** of the indicative points shown. Relevant material is organised with a high degree of clarity and coherence. They use excellent spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates make correct reference to **4–6** of the indicative points shown. 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 make correct reference to **2–3** of the indicative points shown using limited spelling, punctuation and grammar. The organisation of material may lack clarity and coherence The form and style are of limited standard and they have made no use of specialist terms.	[1]–[2]
D	Response not worthy of credit.	[0]

[6]   9

3 (a) Aluminium ion 2.8 [1]
Oxide ion 2.8 [1]
Aluminium ion charge 3$^+$ [1]
Oxide ion charge 2$^-$ [1]   [4]

(b) (i)

Prediction	Prediction is true	Prediction is false
1		✓
2	✓ [1]	
3	✓ [1]	

[2]

(ii) Explanation: **ions** not free to move and carry the charge/current   [1]   7

4 (a) (i) dot and cross methane [1]   must be an attempt at CH$_4$
correct structure methane [1]
correct double bond – oxygen [1]
correct structure oxygen [1] mark dependent on correct double bond [4]

(ii) Arrow/line to pair of electrons (on an O atom)   [1]

(b) van der Waals   [1]   6

5 (a) the solvent (which moves up the paper)   **not** solvent front   [1]

(b) **pencil** line on paper (near bottom) [1]
Idea of put a **spot/dot** (of substance) on line/origin [1]
place in (a little) solvent [1] unless wrongly qualified
(remove and) **mark solvent front** [1]   [4]

(c) R$_f$ = $\dfrac{8.5}{10}$ = 0.85 [2]

for an answer of $\dfrac{9.5}{11}$ = 0.86 award [1]   [2]   7

6 (a) physical state trend: from gas to solid (as Group is descended) [1]
colour trend: idea that colours get darker (as Group is descended) [1]
NB not restating the table results [2]

(b) all need (to gain) one electron [1]
to have a full outer shell/become stable [1] [2]

(c) $F_2 + 2KI \longrightarrow 2KF + I_2$

LHS [1]   RHS [1]
Balancing if all formulae correct [1] [3]

(d) (i) solid [1]
At_2 [1] [2]

(ii) potassium **astatide** [1] 10

7 (a) (i) X = diamond
Y = graphite   accept graphene
Both required [1]

(ii) (carbon) **atoms** [1]

(iii) Physical property: High melting point [1]
Explanation: strong (covalent) **bonds** require large amount of energy
to break [1] [2]
Don't credit wrongly qualified, e.g. ionic or van der Waals

(b) formulation [1]

(c) positive ions (and no negative ions)
the metal atoms/ions in a regular arrangement
delocalised electrons
correct label(s)
four correct marking points = [3];
three correct marking points = [2];
two correct marking points = [1]
for all three marks there needs to be at least one correct label [3]
for an ionic structure award [0]

(d) electrons move [1]
electrons carry the charge/current [1]
apply ECF [2] 10

					AVAILABLE MARKS

8 **(a)** **(i)** 5 [1]

   (ii) 7 [1]

   (iii) Ca(OH)$_2$/calcium hydroxide   apply ECF [1]

   (iv) 5   apply ECF [1]

   (v) 500 g   apply ECF [1]

(b) **(i)** **actual yield** on top line of expression [1]

   (ii) Any **two** from:
   idea of loss of product in separation/loss in transfer/or other loss*
                                        * not just 'lost during reaction'
   idea of side reactions
   idea of reaction not complete   or reversible reaction
   idea of reactants not being pure
   2 × [1] [2]   8

                                                    Total   **70**