Rewarding Learning

General Certificate of Secondary Education
2021–2022

Double Award Science
Chemistry

Unit C1

Higher Tier

[GDW22]

FRIDAY 27 MAY 2022, 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.

COVID-19 Context

Given the unprecedented circumstances presented by the COVID-19 public health crisis, senior examiners, under the instruction of CCEA awarding organisation, are required to train assistant examiners to apply the mark scheme in case of disrupted learning and lost teaching time. The interpretation and intended application of the mark scheme for this examination series will be communicated through the standardising meeting by the Chief or Principal Examiner and will be monitored through the supervision period. This paragraph will apply to examination series in 2021–2022 only.

AVAILABLE MARKS

1 **(a)**

particle	relative charge	relative mass
proton	+1	1 [1]
neutron	0 [1]	1
electron	–1 [1]	$\frac{1}{1840}$

[3]

(b)

atom/ion	mass number	number of protons	number of electrons	number of neutrons
O	**18**	8	**8**	10
Cl^-	37	**17**	18	**20**
Al^{3+}	27	13	**10**	**14**

Each correct row [1] [3]

(c) isotopes [1] 7

2 **(a)** fractional distillation [1]

(b) to find/note/measure the temperature of the vapour/gas [1]

(c) helping to condense the vapour/cool the vapour/provide a cold surface [1]

(d) liquids which mix together (and do not form separate layers)
or idea of mixing - unless wrongly qualified [1]

(e) distillate [1]

(f) idea of showing that it has a specific boiling point [1] 6

3 **(a)** **(i)** two (electrons) [1]

(ii) one (electron) [1]

(iii) XY_2 [1]

(iv) X^{2+} [1]

(b) correct sharing [1]
correct total number of electrons (if all sharing correct)[1]
correct dot/cross [1] [3]

(c) correct sharing for nitrogen [1]
ALL electrons correct including inner [1] if bonding correct
correctly labelled triple bond/multiple bond [1] [3] 10

4 Indicative content

AVAILABLE MARKS

Allotrope
- Different forms/structures
- (of the) Same element
- In the same (physical) state

Diamond bonding and structure
- Covalent bonding NOT "giant covalent bonds"
- Idea that each carbon is joined to 4 others
- Giant (covalent) structure/tetrahedral structure NOT "3D"

Graphite similarities
- Same type of bonding/both covalent
- Also a giant structure
- (both have) Strong bonds

Graphite differences
- Each carbon joined to 3 others
- Idea of layers/hexagonal structure
- Idea of weak bonds between layers/Van der Waals/delocalised electrons

Band	Response	Mark
A	Candidates correctly give **8–12** of the points from the indicative content to answer the question using appropriate scientific terms throughout. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
B	Candidates correctly give **5–7** of the points from the indicative content to answer the question using some scientific terms. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
C	Candidates correctly give **2–4** of the points from the indicative content to answer the question. 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	Response not worthy of credit.	[0]

[6] 6

AVAILABLE MARKS

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

(ii) they increase [1]

(iii) gas [1]

(iv) At [1] NOT At_2
State at room temperature – solid [1] [2]

(b) When a solid changes to a gas (without first forming a liquid) [1]

(c) **(i)** They all have full outer shells of electrons [1]
They don't need to lose or gain electrons to become stable [1] [2]

(ii) (As the relative atomic mass increases) the boiling points also increase [1]

(iii) estimate for radon –63 °C [1] 10

6 **(a)** **(i)** D [1]

(ii) yellow/orange [1]

(iii) 7.0/7 [1]

(iv) B pH of 13.7
or
purple with universal indicator [1]

(b)

metal compound	metal compound soluble in water	acid used	formula of salt produced
potassium carbonate	yes	sulfuric acid	**K_2SO_4 [1]**
copper(II) oxide	**no [1]**	**hydrochloric acid [1]**	$CuCl_2$
magnesium oxide	no	nitric acid	**$Mg(NO_3)_2$ [1]**

[4] 8

7 (a)

type of structure	substance	melting point/ °C	boiling point/ °C	solubility in water	electrical conductivity as solid	electrical conductivity as liquid
metallic	aluminium	660	2470	low	**good**	good
giant ionic	potassium iodide	681	1330	**high**	poor	**good**
giant ionic	sodium sulfate	884	1429	**high**	**poor**	good
molecular covalent	bromine	–7	59	low	poor	**poor**

[1] for 2 correct in each column
additional mark for 3rd correct in first column [5]

(b) it is completely ionised in water/solution (both needed) [1]
Explicit idea that it contains hydroxide/OH^- ions **or** is a soluble base [1] [2]

(c) compound [1] ammonium [1] [2]

(d) $MgCO_3$ + **2**HCl → $MgCl_2$ + H_2O + CO_2
LHS [1] RHS [1]
Balancing if all formulae correct [1] [3] 12

8 (a) … the mass of an atom [1]
compared with that of carbon-12 (isotope) [1]
which has a mass of exactly 12 [1]
or
… the mass of an atom [1]
compared to 1/12 of the mass [1]
of carbon-12 (isotope) [1] [3]

(b) 160 [1]
210 [1] [2]

(c) (i) 24 g [1]

(ii) 8.8 g [2]
Allow method mark for recognising that 0.2 mole CO_2 is formed
or for an answer of 4.4g [2]

(d) (i) 16.8 g [1]

(ii) 82.1 [2]
Award [1] $\frac{13.8}{16.8} \times 100$,

or for answer of 82 or 82.14
Allow ECF from (d)(i)
e.g. (13.8/(d)(i) answer) X 100 [2] 11

Total **70**

AVAILABLE MARKS