Rewarding Learning

General Certificate of Secondary Education
2022

Chemistry

Unit 1

Higher Tier

[GCM12]

FRIDAY 27 MAY, 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 Chemistry.

Candidates must:

AO1 Demonstrate knowledge and understanding of:
- scientific ideas;
- scientific techniques and procedures.

AO2 Apply knowledge and understanding of, and develop skills in:
- scientific ideas;
- scientific enquiry, techniques and procedures.

AO3 Analyse scientific information and ideas to:
- interpret and evaluate;
- make judgements and draw conclusions;
- 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 Chemistry 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)**	**(i)**	hydrogen	[1]	
		(ii)	CO_2/CO	[1]	
		(iii)	any oxide or hydride of a metal: Na_2O; K_2O; CuO; ZnO; NaH; KH; CuH_2; ZnH_2; Cu_2O; CuH	[1]	
	(b)	**(i)**	any **two** from: small piece of metal used [1] use tweezers to lift the potassium [1] large volume of water [1] safety screen [1] remove oil from metal [1]	[2]	
		(ii)	less dense than water	[1]	
		(iii)	heat released/exothermic reaction	[1]	
		(iv)	lilac	[1]	
		(v)	outer electron in sodium lost less readily [1] outer electron closer to nucleus [1] outer electron more attracted to nucleus [1]	[3]	11

2 **(a)** **(i)** atoms with the same number of protons/same atomic number [1]
and a different number of neutrons/different mass number [1] [2]

(ii) 20.2 [2]
20.195 [1] [2]

(iii) $3.50 \times 10^{-15} \times 45000 = 1.575 \times 10^{-10}$ m [1]

$\frac{1.575 \times 10^{-10}}{1 \times 10^{-9}}$ = 0.1575 nm [1] [2]

(b)

Atom/Ion	Atomic number	Mass number	Number of neutrons	Number of protons	Electronic configuration
	1	2			
			20	19	2, 8, 8
Al^{3+}		27		13	
Cl	17	37			
	8		10		2, 8

[1] per row [5]

AVAILABLE MARKS

11

AVAILABLE MARKS

3 **(a)** **(i)** **A** = potassium chloride [1]
B = copper(II) carbonate [1]
C = sulfuric acid [1] [3]

(ii) $Cu(NO_3)_2$ [1]

(iii) contains water of crystallisation [1]

(b) **(i)** **indicative content:**

- place hydrochloric acid in a beaker/conical flask
- add calcium carbonate until in excess/no more gas given off
- filter
- heat filtrate to half volume
- allow to cool and crystallise
- filter off crystals
- dry between two sheets of filter paper/in a desiccator/in a low temperature oven

Band	Response	Mark
A	Candidates must use appropriate specialist terms to fully describe the preparation of the salt (6–7 indicative content points). Relevant material is organised with a high degree of clarity and coherence. They must use excellent spelling, punctuation and grammar and the form and style are of a very high standard.	[5]–[6]
B	Candidates must use appropriate specialist terms to describe the preparation of the salt (4–5 indicative content points). 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 briefly describe the preparation of the salt (2-3 indicative content points). The organisation of material may lack clarity and coherence. They use limited spelling, punctuation and grammar and they have made limited use of specialist terms. The form and style are of limited standard	[1]–[2]
D	A response not worthy of credit	[0]

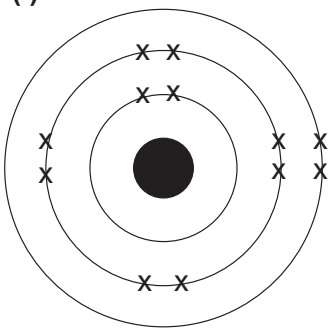
[6]

(ii) $CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H_2O$
correct formulae of reactants [1]
correct formulae of products [1]
correct balancing [1] [3]

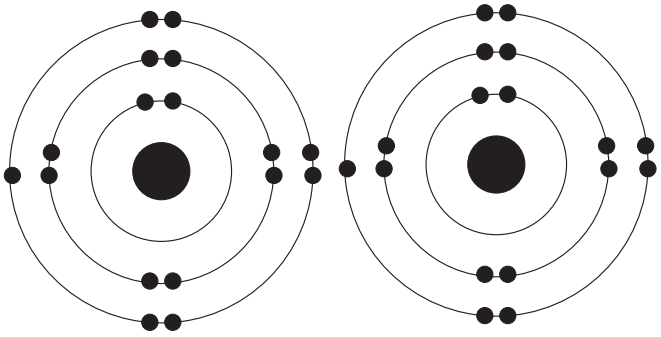
14

AVAILABLE MARKS

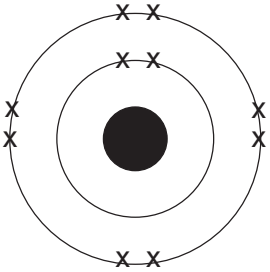
4 **(a)** **(i)**



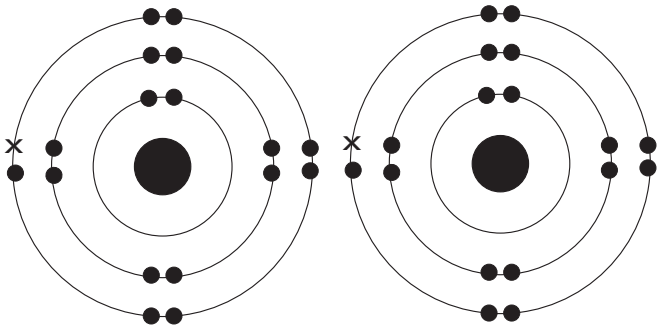
magnesium atom as 2, 8, 2 [1]



2 chlorine atoms as 2, 8, 7 [1]



magnesium ion as 2, 8 [1]



2 chloride ions as 2, 8, 8 [1]

Mg^{2+} [1] Cl^{-} [1] [6]

(ii) attraction between the oppositely charged ions [1]

(b) **(i)**

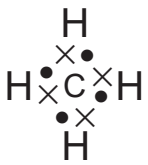
Molecule	Total number of electrons in one molecule	Total number of electrons in covalent bonds in one molecule	Number of lone pairs of electrons in one molecule
chlorine		2	6
nitrogen	14	6	
ammonia	10		1
	[1]	[1]	[1]

[3]

(ii) NCl_3 [1]

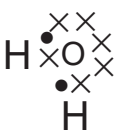
(iii) weak van der Waals' forces between molecules [1]
require little energy to break [1] [2]

(c) methane



[1]

water



[1]

[2]

15

					AVAILABLE MARKS
5	**(a)**	**(i)**	mixture of elements [1] at least one of which is a metal [1] resulting mixture has metallic properties [1]	[3]	
		(ii)	different sized atoms [1] more difficult for layers to slide [1]	[2]	
		(iii)	Ca^{2+} [1] crimson [1] Na^{+} [1]	[3]	
	(b)	**(i)**	solid formed on mixing two solutions	[1]	
		(ii)	Reaction 1: white [1] Reaction 2: brown [1] Reaction 3: yellow [1]	[3]	
		(iii)	$Ba^{2+}(aq) + SO_4^{2-}(aq) \rightarrow BaSO_4(s)$ correct state symbols [1]	[1]	
		(iv)	$Fe^{3+} + 3OH^{-} \rightarrow Fe(OH)_3$ correct formulae of reactants [1] correct formula of product [1] correct balancing [1]	[3]	
		(v)	silver iodide	[1]	17

					AVAILABLE MARKS
6	**(a)**	**(i)**	moles of $Cr_2O_3 = \frac{1900}{152} = 12.5$	[1]	
		(ii)	moles of $Mg = \frac{1200}{24} = 50$	[1]	
		(iii)	chromium(III) oxide/Cr_2O_3	[1]	
		(iv)	moles of Cr = 12.5 × 2 = 25 [1] mass of Cr = 25 × 52 = 1300 [1] g	[2]	
	(b)		mass of H_2O = 10.0 – 5.95 = 4.05 [1] g moles of $H_2O = \frac{4.05}{18} = 0.225$ [1] moles of $Cr(NO_3)_3 = \frac{5.95}{238} = 0.025$ [1] $x = \frac{0.225}{0.025} = 9$ [1]	[4]	
	(c)		moles of $K_2Cr_2O_7 = \frac{1.47}{294} = 0.005$ [1] moles of $O_2 = \frac{0.005}{4} \times 3 = 0.00375$ [1] mass lost = 0.00375 × 32 = 0.12 [1] g	[3]	12
				Total	**80**