Rewarding Learning

General Certificate of Secondary Education
January 2019

GCSE Chemistry

Unit 1

Higher Tier

[GCH12]

MONDAY 21 JANUARY, AFTERNOON

MARK SCHEME

General Marking Instructions and Mark Grids

Introduction
Mark schemes are intended to ensure that the GCSE examination is 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 that they should apply in allocating marks to candidates' responses. The mark schemes should be read in conjunction with these marking instructions.

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 must be positive in their marking, giving appropriate credit for description, explanation and analysis, using knowledge and understanding and for the appropriate use of evidence and reasoned argument to express and evaluate personal responses, informed insights and differing viewpoints. Examiners should make use of the whole of the available mark range of 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.

Types of mark scheme
Mark schemes for 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.

1 (a) (i) any **one** from:
H, O He, Ne [1]

(ii) bromine [1]

(iii) I/C [1]

(iv) copper [1]

(v) Li/Na [1]

(vi) Cu/Fe [1]

(vii) Al [1]

(viii) hydrogen [1] oxygen [1] [2]

(b) Indicative content:

Observations:
floats/on surface [1]
moves [1]
fizzes [1]
heat released [1]
colourless solution formed [1]
eventually disappears [1]
lilac flame [1]
crackle/explosion [1]

Equation:
$2K + 2H_2O \rightarrow 2KOH + H_2$ [3]

Response	Mark
Candidates must use appropriate specialist terms to explain fully the reaction of potassium with water including the balanced symbol equation (9–11 points of indicative content). They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
Candidates must use appropriate specialist terms to explain the reaction of potassium with water (using 5–8 points of indicative content). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
Candidates explain briefly and partially the reaction of potassium with water (using at least 3 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 limited standard.	[1]–[2]
Response not worthy of credit	[0]

[6]

(c) (i) $2K + Cl_2 \rightarrow 2KCl$
correct formulae of reactants [1]
correct formula of product [1]
correct balancing [1] [3]

(ii) white [1]

(iii) $Cl + e^- \rightarrow Cl^-$
$Cl \rightarrow Cl^-$ [1]
$+ e^-$ on LHS (or $– e^-$ on RHS) [1] [2]

AVAILABLE MARKS

21

AVAILABLE MARKS

2 **(a)** **(i)** $CuO + 2HCl \rightarrow CuCl_2 + H_2O$
correct formulae of reactants [1]
correct formulae of products [1]
correct balancing [1] [3]

(ii) (a compound/substance) formed when (some or all of) the hydrogen ions [1] in an acid [1] are replaced with metal ions (other positive ions/ammonium ions) [1]
(**allow** – formed when an acid reacts with base/carbonate/alkali or formed in a neutralisation reaction max [1]) [3]

(iii)

Copper compound	Colour
copper(II) carbonate	green [1]
hydrated copper(II) sulfate	blue [1]

[2]

(b) **(i)** sulfuric acid [1]

(ii) bubbles of gas/fizzing/gas produced [1]
colourless solution remains [1]
heat released [1] **max** [2]

(iii) no more gas produced/no more bubbles [1]

(c) **Indicative content:**
dissolve solid in water/make a solution [1]
add sodium hydroxide solution [1]
white precipitate (indicates Mg^{2+}, Zn^{2+} or Al^{3+} ions present) [1]
add excess sodium hydroxide solution [1]
precipitate does not dissolve (confirms Mg^{2+} ions present) [1]
add barium chloride solution to the solution of magnesium sulfate [1]
white precipitate confirms SO_4^{2-} ions present [1]

Response	Mark
Candidates must use appropriate specialist terms to explain fully the tests for magnesium and sulfate ions (6–7 points of indicative content). They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
Candidates must use appropriate specialist terms to explain the tests for magnesium and sulfate ions (using 4–5 points of indicative content). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
Candidates explain briefly and partially the tests for magnesium and sulfate ions (using at least 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 limited standard.	[1]–[2]
Response not worthy of credit	[0]

[6]

(d) **(i)** potassium/K^+ [1]

(ii) iodide/I^- [1]

(iii) KI [1]

21

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

(ii) 2,8,1 drawn [1]
11 p [1]
11 n [1]
protons and neutrons shown in nucleus [1] [4]

(b)

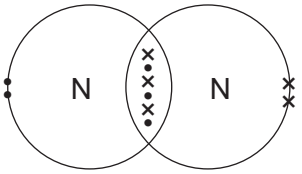
Name of ion	Formula of ion	Number of protons	Number of electrons
sodium ion	Na^+	11	10
nitride ion	N^{3-}	7	10

[1] for each row [2]

(c) **(i)** $2NaN_3 \rightarrow 3N_2 + 2Na$
correct formula and position of reactant with $\rightarrow$ [1]
correct formulae of products [1]
correct balancing [1] [3]

(ii) metallic [1]
attraction between positive ions [1]
and delocalised electrons [1] [3]

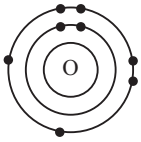
(iii)



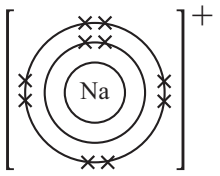
[1]

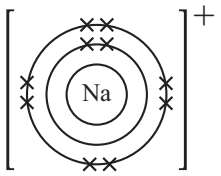
(iv) weak forces between the molecules [1]
which are van der Waals' forces [1]
little energy required to break the forces [1] [3]

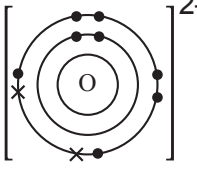
(d)



(sodium atom) 2,8,1 (oxygen atom) 2,6 [1]
2 sodium atoms, 1 oxygen atom [1]







(sodium ion) 2,8 [1]
(oxide ion) 2,8 must be dot and cross [1]
Na^+ [1]
O^{2-} [1] [6]

AVAILABLE MARKS

24

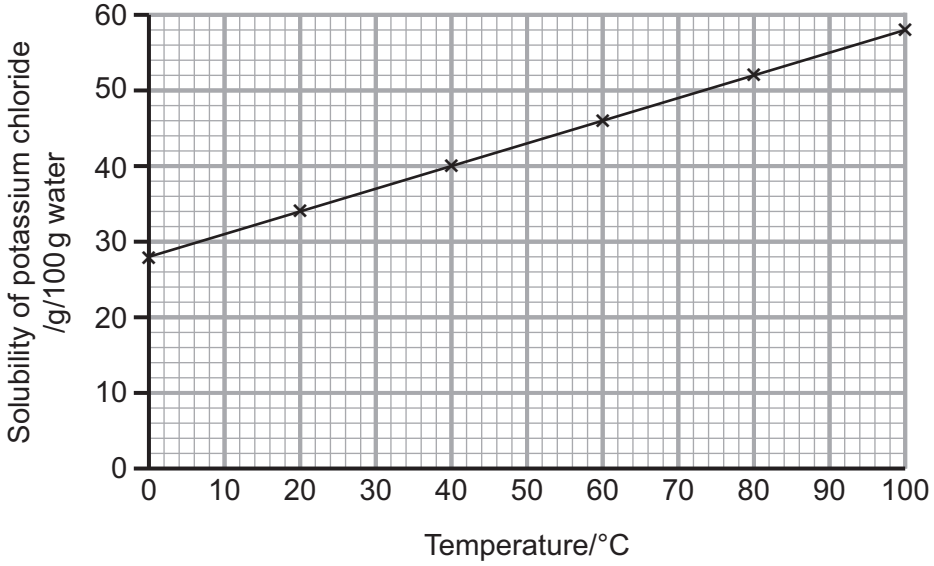
AVAILABLE MARKS

4 **(a)** **(i)** mass of solid [1]
which saturates [1]
100 g of water [1]
at a given temperature [1]
(idea of maximum allowed for saturates) [4]

(ii) increases [1]

(iii) 311 – 216 [1] = 95 [1] g
95/100 × 40 = 38 [1] g [3]

(b)



6 points plotted correctly [2]
4–5 points plotted correctly [1]
smooth line [1] [3]

(c) **(i)** 31 ± 2 [1]

(ii) 73°C ± 2 [1]

(iii) solubility at 70°C = 49 [1] g/100 g water
solubility at 30°C = 37 [1] g/100 g water
difference = 49 – 37 = 12 [1] g
18/12 (or 1.5) × 100 = 150 [1] g of water [4] 17

					AVAILABLE MARKS
5	**(a)**	**(i)**	RFM of NaOH = 40 [1] moles of NaOH = $\frac{1.6}{40}$ = 0.04 [1] ratio is 2:1 so moles of NaOCl = 0.02 [1] RFM of NaOCl = 74.5 [1] mass of NaOCl = 0.02 × 74.5 = 1.49 [1] g	[5]	
		(ii)	$\frac{1.35}{1.49}$ × 100 [1] = 90.6 [1] %	[2]	
	(b)	**(i)**	$CaCl_2$	[1]	
		(ii)	water that is chemically bonded in the crystal structure	[1]	
	(c)	**(i)**	to ensure all the water of crystallisation has been removed	[1]	
		(ii)	mass of H_2O = 14.28 – 13.92 = 0.36 g	[1]	
		(iii)	RFM of H_2O = 18 [1] moles of H_2O = $\frac{0.36}{18}$ = 0.02 [1]	[2]	
		(iv)	mass of $CaSO_4$ = 13.92 – 12.56 = 1.36 g	[1]	
		(v)	RFM of $CaSO_4$ = 136 [1] moles of $CaSO_4$ = $\frac{1.36}{136}$ = 0.01 [1]	[2]	
		(vi)	x = 2	[1]	17
				Total	**100**