Rewarding Learning

General Certificate of Secondary Education
2016

GCSE Chemistry

Unit 1

Higher Tier

[GCH12]

WEDNESDAY 15 JUNE, 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 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 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.

					AVAILABLE MARKS
1	(a)	(i)	moves about [1] releases heat [1] fizzes or hisses or gas produced [1] melts to form a silvery ball [1] max [3]		
		(ii)	$K \rightarrow K^+ + e^-$ [1] for $K \rightarrow K^+$ [1] for e^- placed correctly with + or – as appropriate	[2]	
		(iii)	$2NaBr + Cl_2 \rightarrow 2NaCl + Br_2$ [1] for correct formulae of reactants [1] for correct formulae of products [1] for correct balancing	[3]	
		(iv)	colourless [1] to orange [1]	[2]	
		(v)	$Br_2 + 2e^- \rightarrow 2Br^-$ [1] for Br_2 and Br^- [1] for e^- placed correctly with + or – as appropriate [1] for correct balancing	[3]	
	(b)	(i)	3	[1]	
		(ii)	88	[1]	
		(iii)	strontium	[1]	
		(iv)	small sample/identification of elements/fast	[1]	17

AVAILABLE MARKS

2 **(a)** **(i)** bubbles/fizzing/gas produced [1]
tablet disappears [1]
heat released [1]
colourless solution forms [1] max [3]

(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]

(b) **(i)** $Al(OH)_3$ [1]

(ii) white [1]

(iii) add sodium hydroxide (solution) [1]
white precipitate [1]
add excess sodium hydroxide (solution) [1]
precipitate redissolves [1]
Zn^{2+}/zinc ions give the same result [1] [5]

(c)

Metal ion	Flame colour
Na^+	**(golden) yellow/orange** [1]
Ca^{2+} [1]	Brick red
Ba^{2+}	**(apple) green** [1]

[3]

(d) **Indicative content**

- dissolve supplement in water [1]
- add sodium hydroxide [1] (solution)
- green precipitate confirms presence of iron(II) ions [1]
- $Fe^{2+} + 2OH^- \rightarrow Fe(OH)_2$ [3]
- add barium chloride [1] (solution)
- white precipitate confirms presence of sulfate ions [1]
- $Ba^{2+} + SO_4^{2-} \rightarrow BaSO_4$ [2]

Response	Mark
Candidates must use appropriate specialist terms to explain fully how to test for the presence of iron(II) ions and sulfate ions (using 8–10 points of indicative content). They use good spelling, punctuation and grammar and the form and style are of a high standard.	[7]–[9]
Candidates must use appropriate specialist terms to explain how to test for the presence of iron(II) ions and/or sulfate ions (using 5–7 points of indicative content). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[4]–[6]
Candidates partially describe the test for the presence of iron(II) ions and sulfate ions (using 2–4 points of indicative content). They use limited spelling, punctuation and grammar and they make little use of specialist terms. The form and style are of a limited standard.	[1]–[3]
Response not worthy of credit	[0]

[9]

25

AVAILABLE MARKS

3 (a) (i) mixture [1]
of two or more elements at least one of which is a metal [1] [2]

(ii)

	Type of bonding	Type of structure
Graphite	covalent [1]	giant [1]
Iron	metallic [1]	metallic [1]

[4]

(iii) Indicative content

Graphite
- Layers (of carbon atoms) [1]
- Carbon atoms bonded to three others [1]
- Weak forces (of attraction) between the layers [1]
- One electron free per carbon/delocalised electrons (between layers) [1]
- Hexagonal (arrangement of carbon atoms) [1]

Iron
- Regular arrangement/lattice/layers [1]
- Positive ions [1]
- (Sea of) delocalised electrons [1]
- Attraction between positive ions and delocalised electrons [1]

Response	Mark
Candidates must use appropriate specialist terms to explain fully the structures of graphite and iron (using 7–9 points of indicative content). They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
Candidates use some appropriate specialist terms to explain structure of graphite and iron (using 4–6 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 structures of graphite and iron (using 2–3 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 a limited standard.	[1]–[2]
Response not worthy of credit	[0]

[6]

(b) (i) covalent [1]

(ii) ionic [1]

(iii) (Sodium atom) 2,8,1 (oxygen atom) 2,6 [1]
Two 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]
Electronic configurations must be **drawn**

				AVAILABLE MARKS

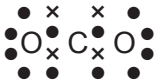
(c) **(i)**

Formula of ion	Number of protons	Number of electrons	Number of neutrons
Fe^{2+} [1]	26 [1]	24 [1]	30 [1]

[4]

(ii) a charged particle formed when an atom gains or loses electrons [1]

(d)



2 bonded pairs of electrons between C and each of the O atoms [1]
2 lone pairs of electrons on each oxygen [1]
dot and cross mark depends on first mark [1] [1] [3] 28
(if correct number of electrons shown)

4 **(a)** Mass [1] of solid required to saturate [1] 100 g of water [1]
at a particular temperature [1] [4]

(b) **(i)** D [1]

(ii) 56 (±1) (°C) [1]

(iii) 70 (±1) (°C) [1]

(iv) 1 [1]
3 [1] [2]

(v) solubility at 60 °C = 46 [1] g/100g water
12 [1] g per 100 g deposited
46 –12 = 34 [1] g
Temperature = 20 [1] °C
all solubilities ±1 [4] 13

					AVAILABLE MARKS
5	**(a)**	**(i)**	thermal [1] decomposition [1]	[2]	
		(ii)	moles of magnesium nitrate = $\frac{4.44}{148\,[1]}$ = 0.03 [1] ratio $Mg(NO_3)_2 : NO_2$ = 2:4/moles of NO_2 = 0.06 [1] mass of NO_2 = 0.06 × 46 [1] = 2.76 [1] g	[5]	
	(b)	**(i)**	(15.90 – 14.82) = 1.08 (g)	[1]	
		(ii)	$\frac{1.08}{18}$ = 0.06 [1]	[1]	
		(iii)	(14.82 – 13.87) = 0.95 (g)	[1]	
		(iv)	$\frac{0.95}{95}$ = 0.01 [1]	[1]	
		(v)	(0.01:0.06) n = 6 [1]	[1]	
	(c)		mass of magnesium chloride = 475000 [1] g moles of magnesium chloride = 5000 [1] ratio $Mg(OH)_2 : HCl$ = 1:2/moles of HCl = 10000 [1] mass of HCl = 10000 × 36.5 = 365000 [1] g mass of HCl = 365 [1] kg	[5]	17
				Total	**100**