Rewarding Learning

General Certificate of Secondary Education
2017

GCSE Chemistry

Unit 1

Higher Tier

[GCH12]

WEDNESDAY 14 JUNE, MORNING

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)**	alkali metals	[1]	
		(ii)	shiny [1] changes to dull/tarnished [1]	[2]	
		(iii)	Li	[1]	
	(b)	**(i)**	5	[1]	
		(ii)	3	[1]	
	(c)	**(i)**	noble gases	[1]	
		(ii)	full **outer** shell (of electrons) [1] idea of stability [1]	[2]	
	(d)	**(i)**		[2]	
		(ii)	decreases	[1]	
	(e)	**(i)**	colourless [1] to brown [1]	[2]	
		(ii)	$2I^- \rightarrow I_2 + 2e^-$ I^- on left and I_2 on right [1] $+e^-$ on right (or $-e^-$ on left) [1] correct balancing [1]	[3]	17
2	**(a)**	**(i)**	burette	[1]	
		(ii)	conical flask	[1]	
		(iii)	pH meter/pH probe	[1]	
		(iv)	to ensure mixing (to ensure the reaction is complete)	[1]	
		(v)	pH 12 (from graph) [1] alkaline [1]	[2]	
		(vi)	pH falls [1] idea of gradual decrease followed by rapid decrease [1]	[2]	
		(vii)	$H^+ + OH^- \rightarrow H_2O$ correct formulae of reactants [1] correct formula of product [1]	[2]	
		(viii)	11.2–11.5 cm^3 (units essential)	[1]	

Element	Colour	Physical state at room temperature
Chlorine	green/yellow-green [1]	gas
Iodine	dark grey	solid [1]

(b) (i)

test	Observation	deduction
1. flame test	**yellow/orange (flame)** [1]	Sodium ion present
2. (i) add 1 cm^3 of sodium hydroxide solution (ii) add excess sodium hydroxide solution	**White precipitate** [1] **Precipitate redissolves** [1]	Zinc ions present
3. add some barium chloride solution	**White precipitate** [1]	Sulfate ions present
4. add some silver nitrate	**White precipitate** [1]	Chloride ion present

[5]

(ii) $Ag^+ + Cl^- \rightarrow AgCl$
correct formulae of reactants [1]
correct formula of product [1] [2]

(iii) $ZnCl_2$ [1]
Na_2SO_4 [1]
NaCl [1]
$ZnSO_4$ [1]
Any 2 [2]

AVAILABLE MARKS

20

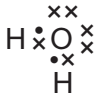
3 **(a)** **(i)** B [1]

(ii) D [1]

(iii) F [1]

(iv) NH_3 [1]

(v) For C



[1]

For E

[1] [2]

(vi) weak forces between molecules [1]
called van der Waals [1]
forces require little (heat) energy to break [1] [3]

(vii) shared electrons [1]
pair of electrons [1] [2]

(viii) $H_2 + Cl_2 \rightarrow 2HCl$
correct formulae of reactants [1]
correct formula of product [1]
correct balancing [1] [3]

(ix) NH_4Cl [1]

(b)

Ion	Atomic number	Mass number	Number of protons	Number of electrons	Number of neutrons
Mg^{2+}	12	24	12	10	12
O^{2-}	8	**16**	**8**	**10**	8
K^+	19	39	**19**	18	**20**
Zn^{2+}	**30**	**65**	30	28	35
Sc^{3+}	**21**	45	21	**18**	**24**
I^-	53	127	**53**	54	**74**

[1] for each correct column [6]

(c) **(i)** magnesium oxide [1]

(ii) substantial energy required to break [1]
strong (ionic) bonds [1]
ions can move and carry charge [1] [3]

AVAILABLE MARKS

25

4 **(a)** $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$
correct formulae of reactants [1]
correct formulae of products [1]
correct balancing [1] [3]

(b) $CuO + H_2SO_4 \rightarrow CuSO_4 + H_2O$
correct formulae of reactants [1]
correct formulae of products [1] [2]

(c) **Indicative content**

For sodium sulfate
I_1 measured volume of sulfuric acid
I_2 correctly named indicator
I_3 add NaOH from burette until colour change
I_4 note volume and repeat with no indicator/**heat** with **charcoal** and **filter**

For copper(II) sulfate
I_5 add sulfuric acid to copper (II) oxide/add copper (II) oxide to sulfuric acid
I_6 heat
I_7 copper (II) oxide in excess
I_8 filter off excess copper (II) oxide

Response	**Mark**
Candidates must use appropriate specialist terms throughout to fully compare and contrast these two reactions (using 7–8 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 compare and contrast these two reactions (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 briefly and partially compare and contrast these two reactions (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]

(d) **(i)** to prevent removal of water of crystallisation [1]

(ii) solubility decreases as temperature decreases [1]

(iii) any **two** from
between filter paper
in a low temperature oven
in a desiccator [2]

(e) mass of copper(II) sulfate = 4.5 g [1]
mass of water = 12.5 g [1]
36 g/100 g [1] [3]

AVAILABLE MARKS

18

5 (a)

Substance	Mass	Relative formula mass	Moles
$Ca(OH)_2$		74 [1]	0.0025 [1]
$Ca(HCO_3)_2$	3.24 [1] kg	162 [1]	
$(C_{17}H_{35}COO)_2Ca$	909 [1] g	606 [1]	

[6]

(b) Indicative content:

I_1 Weigh container with hydrated solid
I_2 Heat and weigh
I_3 Repeat until mass no longer changes/consecutive mass the same
I_4 Subtract final mass from initial mass to find mass of water
I_5 Evaporating basin/crucible
I_6 Bunsen burner with tripod, gauze/pipe-clay triangle if crucible used

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

[6]

(c) Method 1

Moles of $CaCl_2.6H_2O = \frac{1.095}{219\ [1]} = 0.005$ [1] moles

Mass of $CaCl_2$ = 0.005 [1] × 111 [1] = 0.555 [1] g

Loss in mass = 1.095 – 0.555 = 0.54 [1] g

Method 2

Moles of $CaCl_2.6H_2O = \frac{1.095}{219\ [1]} = 0.005$ [1] moles

Moles of H_2O lost = 0.005 × 6 [1] = 0.03 [1]

Mass loss = 0.03 × 18 [1] = 0.54 [1] g [6]

(d) $\frac{108}{219}$ [1] × 100 = 49.3 [1] % [2]

Total

AVAILABLE MARKS
20
100