Rewarding Learning

General Certificate of Secondary Education
2017

GCSE Chemistry

Unit 2

Higher Tier

[GCH22]

WEDNESDAY 21 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 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, the 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.

					AVAILABLE MARKS
1	**(a)**	**(i)**	bauxite	[1]	
		(ii)	reduce operating temperature/reduce melting point [1] increase conductivity [1] (of molten ore)	[2]	
		(iii)	$Al^{3+} + 3e^- \rightarrow Al$ Al^{3+} on left and Al on right [1] $+e^-$ on left [1] correct balancing [1]	[3]	
		(iv)	oxygen $2O^{2-} \rightarrow O_2 + 4e^-$ O^{2-} on left and O_2 on right [1] $+e^-$ on right (or $-e^-$ on left) [1] correct balancing [1]	[1] [3]	
	(b)		any **two** from: • labour force • availability of raw materials • infrastructure • availability of a cheaper source of electricity • not in an area of outstanding natural beauty	[2]	12

AVAILABLE MARKS

2 **(a)** **(i)** same general formula [1]
differ by a CH_2 (unit) [1]
similar chemical properties [1]
gradation in physical properties [1] max [3]

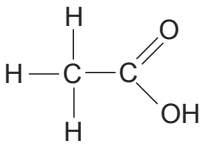
(ii)

Name	Molecular formula	Physical state at room temperature
ethene	C_2H_4 [1]	gas
propene [1]	C_3H_6	gas [1]

[3]

(iii) C═C [1]

(b) **(i)**



[1]

(ii) partially ionised in water [1]

(c) **(i)** $2CH_3COOH + Mg \rightarrow (CH_3COO)_2Mg + H_2$
correct formulae of reactants [1]
correct formulae of products [1]
correct balancing [1] [3]

(ii) bubbles/fizzing/gas produced [1]
heat released [1]
metal or magnesium disappears [1]
solution remains colourless [1] max [3]

15

				AVAILABLE MARKS
3	**(a)**	**(i)**	A [1] highest concentration of acid [1] fastest reaction/steepest slope/finishes first [1] [3]	
		(ii)	starts at origin [1] steeper line [1] levels off at 55 cm^3 [1] [3]	
	(b)		particles move faster/gain (kinetic) energy [1] more successful collisions/more collisions with the activation energy [1] in a given period of time [1] [3]	
	(c)		minimum energy required for a reaction to occur [1]	10

AVAILABLE MARKS

4 **(a)** **(i)** any **two** from:
colourless
pungent
less dense than air
soluble in water [2]

(ii) $(NH_4)_2SO_4 + 2NaOH \rightarrow 2NH_3 + Na_2SO_4 + 2H_2O$
correct formulae of reactants [1]
correct formulae of products [1]
correct balancing [1] [3]

(b) **(i)** nitrogen gains hydrogen [1]
gain of hydrogen is reduction [1] [2]

(ii) reversible (reaction) [1]

(iii) glass rod/stopper from bottle [1]
concentrated hydrochloric acid [1]
white smoke/fumes/clouds [1] [3]

(c) **(i)** $4NH_3 + 3O_2 \rightarrow 2N_2 + 6H_2O$
correct formulae of reactants [1]
correct formulae of products [1]
correct balancing [1] [3]

(ii) triple covalent bond [1]
requires a lot of energy to break bond [1] [2]

(d) **indicative content**

I1–I3 $Mg^{2+} + 2OH^- \rightarrow Mg(OH)_2$ [3]
I4 white precipitate [1]
I5 does not dissolve on addition of excess $NH_3(aq)$ [1]
I6–I8 $Cu^{2+} + 2OH^- \rightarrow Cu(OH)_2$ [3]
I9 blue precipitate [1]
I10 dissolves on addition of excess $NH_3(aq)$ to form a deep/dark blue solution [1]

Response	Mark
Candidates must use appropriate specialist terms to explain fully the observations and equations (using 8–10 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 observations and equations (using 4–7 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 observations and equations (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]

22

				AVAILABLE MARKS
5	**(a)**	$2Cu + O_2 \rightarrow 2CuO$ correct formulae of reactants [1] correct formula of product [1] correct balancing [1]	[3]	
	(b)	**(i)** green [1] to black [1]	[2]	
		(ii) $CuCO_3 \rightarrow CuO + CO_2$ correct formula of reactant [1] correct formulae of products [1]	[2]	
	(c)	**(i)** $CuO + H_2 \rightarrow Cu + H_2O$ correct formulae of reactants [1] correct formulae of products [1]	[2]	
		(ii) a suitable reaction vessel containing copper(II) oxide [1] direct heating of copper(II) oxide [1] hydrogen gas passing over solid [1] hydrogen burning on exit [1]	[4]	
	(d)	**(i)** $4CuO + CH_4 \rightarrow CO_2 + 2H_2O + 4Cu$ correct formulae of reactants [1] correct formulae of products [1] correct balancing [1]	[3]	
		(ii) does not contain water of crystallisation	[1]	17

AVAILABLE MARKS

6 **(a)** **(i)** $Sr + 2H_2O \rightarrow Sr(OH)_2 + H_2$
correct formulae of reactants [1]
correct formulae of products [1]
correct balancing [1] [3]

(ii) K floats and Sr sinks [1]
(lilac) flame and no flame [1]
both produce a gas/fizz [1]
both disappear [1] max [3]

(b) **(i)** $Sr + 2AgNO_3 \rightarrow Sr(NO_3)_2 + 2Ag$
correct formulae of reactants [1]
correct formulae of products [1]
correct balancing [1] [3]

(ii) calcium nitrate [1]
cadmium [1] [2]

(iii) strontium above calcium [1] and below potassium [1] dependent on 1st mark
cadmium between iron and copper [1] [3]

(iv) **indicative content**

I1–I2	iron loses electrons/$Fe \rightarrow Fe^{2+} + 2e^-$ [2]
I3	loss of electrons is oxidation [1]
I4–I5	cadmium **ions** gain electrons/$Cd^{2+} + 2e^- \rightarrow Cd$ [2]
I6	gain of electrons is reduction [1]
I7	redox is oxidation and reduction occurring simultaneously in the same reaction [1]

Response	Mark
Candidates must use appropriate specialist terms to explain fully the redox process (using 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 use some appropriate specialist terms to explain the redox process (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 briefly and partially explain the redox process (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]

(c) **(i)** barium sulfate [1]

(ii) low solubility/insoluble (in water) [1] 22

				AVAILABLE MARKS
7	**(a)**	RFM of $Ba(OH)_2.8H_2O$ = 315 [1] mass = 0.25 × 315 = 78.75 [1] g	[2]	
	(b)	15.25 g × 4 = 61 [1] g/dm^3	[1]	
	(c)	**(i)** to clearly view colour (change)	[1]	
		(ii) blue to green/yellow	[1]	
		(iii) any **two** from: dropwise addition near end-point swirling read bottom of meniscus	[2]	
	(d)	**(i)** 20.0/20 [2] 20.3 [1] (use of rough titration)	[2]	
		(ii) moles HCl = $\frac{20.0 \times 1.25}{1000}$ [1] = 0.025 [1] mol moles $M(OH)_2$ = $\frac{0.025}{2}$ [1] = 0.0125 [1] concentration of $M(OH)_2$ = 0.0125 × $\frac{1000}{25}$ = 0.5 [1] mol/dm^3	[5]	
		(iii) $\frac{61}{0.5}$ = 122 [1] 122 – 34 = 88 [1] strontium [1]	[3]	17
			Total	**115**