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Rewarding Learning

General Certificate of Secondary Education
2015

GCSE Chemistry

Unit 2

Higher Tier

[GCH22]

WEDNESDAY 17 JUNE, MORNING

MARK SCHEME

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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, 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.

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					AVAILABLE MARKS
1	(a)	(i)	water which does not lather readily with soap water which does not lather with soap = [1]	[2]	
		(ii)	deliquescent	[1]	
		(iii)	temporary hardness removed by boiling [1] permanent hardness is not removed by boiling [1]	[2]	
	(b)	(i)	washing soda	[1]	
		(ii)	$Ca^{2+}(aq) + CO_3^{2-}(aq) \rightarrow CaCO_3(s)$ correct formulae of reactants [1] correct formula of product [1] correct state symbols [1]	[3]	
		(iii)	ion exchange/distillation	[1]	
		(iv)	tastes better/better for **specified** health benefit, e.g. teeth, bones	[1]	11

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AVAILABLE MARKS

2 (a) Indicative content

- sugar/glucose (or source of sugar such as fruit)
- in solution
- yeast (or zymase)
- absence of air/anaerobic conditions
- warm conditions
- carbon dioxide also produced

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

(b) (i) C_nH_{2n+2} [1]

(ii) compound containing **only** carbon and hydrogen atoms [1]

(iii) $C_8H_{18} + 12\frac{1}{2}O_2 \rightarrow 8CO_2 + 9H_2O$

correct formulae of reactants [1]
correct formulae of products [1]
correct balancing allow multiples [1] [3]

(c) (i) A = ethene [1]
B = ethanol [1]
C = ethanoic acid [1] [3]

(ii) steam [1]

(iii) orange to green [1]

(iv) A [1] 17

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					AVAILABLE MARKS
3	(a)	(i)	80 (s) (allow 78–82)	[1]	
		(ii)	$\frac{1}{80}$ [1] = 0.0125 [1] allow consequential marking from **(a)(i)**	[2]	
	(b)	(i)	D	[1]	
			faster reaction/steeper slope [1] finishes at same gas volume [1]	[2]	
		(ii)	B	[1]	
		(iii)	A [1] half mass used so half volume produced/less gas produced [1]	[2]	
		(iv)	Effect: (increasing concentration) increases rate	[1]	
			Explanation: more particles (in same volume) [1] more collisions in a given time [1] with the activation energy/successful collisions [1]	[3]	
	(c)	(i)	cobalt nitrate [1] shortest time/fastest reaction [1]	[2]	
		(ii)	minimum energy particles need to react	[1]	16

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AVAILABLE MARKS

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

Property \ Gas	Sulfur dioxide	Nitrogen
Colour	colourless [1]	colourless [1]
Acidic, basic or neutral	acidic [1]	neutral

[3]

(ii) triple covalent bond [1]
requires substantial energy to break/strong bond [1] [2]

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

(ii) hydrogen [1]

(iii) 200 atm–1000 atm [1]

(iv) $N_2 + 3H_2 \rightleftharpoons 2NH_3$
correct formulae of reactants [1]
correct formula of product [1]
correct balancing [1] [3]

(v) iron [1]

(vi) 450 °C (350 °C–550 °C) [1]

(vii) **Ammonia** condenses/changes to a liquid [1]

(viii) Idea of increase (total) yield of ammonia/prevent waste/reduce cost as less raw materials need to be purchased [1]

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

(d) add ammonia solution [1]
red-brown [1] ppt [1] [3]

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AVAILABLE MARKS

5 **(a)** **(i)** continental drift [1]

(ii) Idea that Wegener could not explain how it happened [1]

(b) **(i)** $FeCl_2$ [1]

(ii) rust [1]

(iii) iron gains oxygen/iron loses electrons [1]
gain of oxygen is oxidation/loss of electrons is oxidation [1] [2]

(iv) apply lit splint [1] pop [1] [2]

(v) $Fe + CuSO_4 \rightarrow FeSO_4 + Cu$
correct formulae of reactants [1]
correct formulae of products [1] [2]

(vi) **Indicative content**

- iron loses electrons [1]/$Fe \rightarrow Fe^{2+} + 2e^-$ [2]
- loss of electrons is oxidation
- copper **ions** gain electrons [1]/$Cu^{2+} + 2e^- \rightarrow Cu$ [2]
- gain of electrons is reduction
- redox is oxidation and reduction occurring simultaneously

Response	Mark
Candidates must use appropriate specialist terms to explain why this reaction is a redox reaction (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 fully why this reaction is a redox reaction (using 3–5 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 why this reaction is a redox reaction (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] 16

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					AVAILABLE MARKS
6	**(a)**	haematite		[1]	
	(b)	**(i)** coke/carbon [1] reacts (with oxygen) to form carbon dioxide [1] carbon dioxide reacts with (more) coke/carbon to form carbon monoxide [1]		[3]	
		(ii) $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$ correct formulae of reactants correct formulae of products correct balancing	[1] [1] [1]	[3]	
		(iii) $CaCO_3 \rightarrow CaO + CO_2$ correct formula of reactant correct formulae of products	[1] [1]		
		$CaO + SiO_2 \rightarrow CaSiO_3$ correct formulae of reactants correct formula of product	[1] [1]		
		The SiO_2/silicon dioxide/sand is the impurity The slag is tapped off at the bottom of the furnace	[1] [1]	[6]	
	(c)	bauxite		[1]	
	(d)	decomposition (of an ionic compound) using (a direct current of) electricity	[1] [1]	[2]	
	(e)	$Al^{3+} + 3e^- \rightarrow Al$ correct ion and electron on left hand side correct atom on right hand side correct balancing of electrons	[1] [1] [1]	[3]	19

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					AVAILABLE MARKS
7	(a)	(i)	pipette	[1]	
		(ii)	any **four** from: rinse with **distilled** water [1] rinse with (sodium hydroxide) solution [1] fill (using filter funnel) [1] ensure jet is filled/ensure no air bubbles [1]	[4]	
		(iii)	colourless [1] to pink [1]	[2]	
	(b)	(i)	$\frac{26.5 \times 0.2}{1000} = 0.0053$	[1]	
		(ii)	1:1 ratio so 0.0053	[1]	
		(iii)	$0.0053 \times 40 = 0.212$	[1]	
		(iv)	60 [1] $0.212 \times 60 = 12.72$ (g/dm^3) [1]	[2]	
	(c)		$\frac{12}{60} = 0.2$ [1] $\left.\frac{0.2 \times 1000}{50}\right\}$[1] = 4 [1] mol/dm^3	[3]	15
				Total	**115**