Rewarding Learning

General Certificate of Secondary Education
2014

GCSE Chemistry

Unit 2

Higher Tier

[GCH22]

THURSDAY 19 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, the examiners should seek the guidance of the Supervising Examiner.

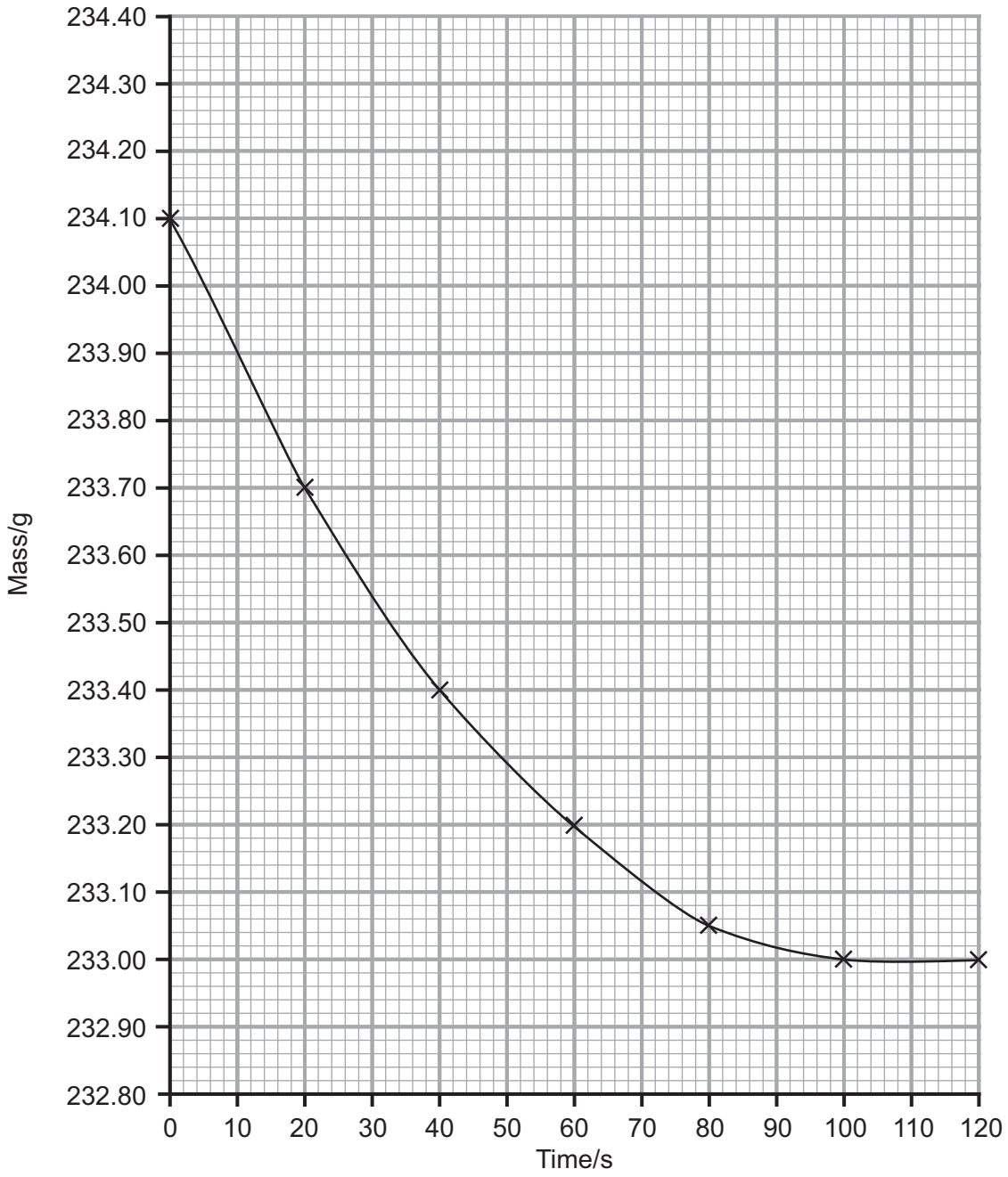
Positive marking
Examiners must be positive in their marking, giving appropriate credit for description, explanation and analysis, using knowledge and understanding and for the appropriate use of evidence and reasoned argument to express and evaluate personal responses, informed insights and differing 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)**	conical flask with cotton wool plug	[1]		
		placed on electronic balance	[1]		
		tablet in contact with water	[1]		
		timer/stopclock/stopwatch	[1]	[4]	
		No labels = [0]			
	(b)	**(i)** 5–7 points plotted correctly	[3]		
		2–4 points plotted correctly	[2]		
		1 point plotted correctly	[1]		
		smooth **curve**	[1]	[4]	
		(ii) 95–100 seconds units essential		[1]	
		(iii) 1.10 g units essential allow 1.1 g		[1]	
		(iv) graph starts at (0, 234.1) **and** remains lower	[1]		
		levels off earlier	[1]		
		levels off at same mass reading as initial graph	[1]	[3]	
		(v) particles have more energy/move faster	[1]		
		idea of more **successful** collisions	[1]		
		per unit time	[1]	[3]	
	(c)	**minimum** energy [1] which (reactant) particles need to react [1] (energy which particles need to react [1])		[2]	18



AVAILABLE MARKS

2 Indicative content

- sulfur burns in (oxygen from) **air** producing sulfur dioxide
- $S + O_2 \rightarrow SO_2$ [2]
- sulfur dioxide **reacts** with (more) oxygen (from air) forming sulfur trioxide
- $2SO_2 + O_2 \rightleftharpoons 2SO_3$ [3]
- in the presence of a vanadium(V) oxide catalyst
- at 450 °C and 2 atm pressure (1–10 accepted)
- sulfur trioxide reacts with **concentrated** sulfuric acid to form oleum
- $SO_3 + H_2SO_4 \rightarrow H_2S_2O_7$ [2]
- oleum diluted to form sulfuric acid
- $H_2S_2O_7 + H_2O \rightarrow 2H_2SO_4$ [3]

Response	Mark
Candidates must use appropriate specialist terms to explain fully the industrial manufacture of sulfuric acid (using a minimum of 11 points of indicative content) including at least **three** balanced symbol equations and a logical sequence. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[9]–[12]
Candidates must use appropriate specialist terms to explain fully the industrial manufacture of sulfuric acid (using a minimum of 6 points of indicative content) including at least **two** balanced symbol equations and a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[5]–[8]
Candidates explain briefly and partially the industrial manufacture of sulfuric acid (using a minimum of 2 points of indicative content) including at least **one** balanced symbol equation. 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]–[4]
Response not worthy of credit	[0]

[12] 12

Award indicative content marks for catalyst and conditions only if referring to correct stage.

AVAILABLE MARKS

					AVAILABLE MARKS
3	**(a)**	**(i)**	breaking down (a substance) [1] using heat [1]	[2]	
		(ii)	$2Fe(OH)_3 \rightarrow Fe_2O_3 + 3H_2O$ [1] for correct formula of reactant [1] for correct formulae of products [1] for correct balancing	[3]	
	(b)		Any **two** from: volcanoes/earthquakes/mountain **formation**	[2]	
	(c)		A comparison of three of the following gases: Nitrogen [1] Oxygen [1] Carbon dioxide [1] Noble gases [1] max [3] Two correct percentages of gases in Earth's atmosphere [2]	[5]	
	(d)	**(i)**	$\mathbf{6}CO_2 + \mathbf{6}H_2O \rightarrow C_6H_{12}O_6 + \mathbf{6}O_2$ [1] for correct balancing	[1]	
		(ii)	energy taken in to break bonds [1] in carbon dioxide **and** water [1] is more than [1] energy released when bonds are made [1] in $C_6H_{12}O_6$ (glucose) **and** oxygen [1]	[5]	18

AVAILABLE MARKS

4 (a) Indicative content

- Add soap (solution) to sample of water **and shake**
- If scum forms/there is no immediate lather, the water is hard
- Take another sample of the water
- Boil it
- Add soap solution and shake
- If a lather forms – temporary hardness
- If no lather – permanent hardness

Response	Mark
Candidates must use appropriate specialist terms throughout to describe fully how a sample of water is tested for hardness and how to determine if the hardness is temporary or permanent (6–7 points from the indicative content above) in a logical sequence. 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 describe how a sample of water is tested for hardness and/or how to determine if the hardness is temporary or permanent (3–5 points from the indicative content above) in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
Candidates describe how to test a sample of water for hardness and/or how to determine if the hardness is temporary or permanent (1–2 points from the indicative content above) which may not be in a logical sequence. 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) $CaCO_3 + CO_2 + H_2O \rightarrow Ca(HCO_3)_2$
[1] for correct formulae of reactants
[1] for correct formula of product [2]

(ii) calcium carbonate reacts with (rain)water [1]
containing dissolved carbon dioxide [1]
forming **soluble** calcium hydrogen carbonate/forms calcium hydrogen carbonate **solution** [1] [3]

(iii) ion exchange [1]
addition of washing soda [1]
(allow distillation) [2]

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AVAILABLE MARKS

5 **(a)** **(i)** show **similar** chemical properties/differ by a CH_2 (unit/group) [1]

(ii)

Name of homologous series	General formula	Molecular formula of compound with three carbon atoms
Alkanes	C_nH_{2n+2} [1]	C_3H_8
Alkenes	C_nH_{2n}	C_3H_6 [1]

[2]

(iii) propane [1]

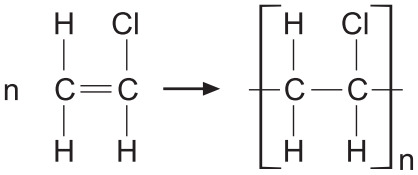
(b) **(i)** reaction of a fuel [1]
reaction with oxygen [1]
forming oxides [1]
and releasing heat [1]
max [3] [3]

(ii) $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$
[1] for correct formulae of reactants
[1] for correct formulae of products
[1] for correct balancing [3]

(c) **(i)** a reactive group in a molecule [1]

(ii) bromine water [1]
(changes from) red-brown/orange/yellow [1] to colourless [1] [3]

(d) **(i)**



[1] for correct structure of the monomer
[1] for n before the monomer structure
[1] for correct structure of the polymer in [ ] with bonds through the [ ]
[1] for repeat indicated in polymer [4]

(ii) more durable/does not rot [1]

(e) **(i)** methanol [1]

(ii) COOH/carboxyl accept carboxylic acid [1]

(iii) only contains carbon and hydrogen (atoms) [1]

(iv) **B** accept CH_3COOH/ethanoic acid [1]

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					AVAILABLE MARKS
6	**(a)**	**(i)**	$2AgNO_3 + Cu \rightarrow Cu(NO_3)_2 + 2Ag$ [1] for correct formulae of reactants [1] for correct formulae of products [1] for correct balancing	[3]	
		(ii)	silver indicated below copper	[1]	
		(iii)	blue	[1]	
		(iv)	copper is more reactive/higher in reactivity series [1] than silver [1]	[2]	
	(b)	**(i)**	1×10^{-9} **m or** other suitable idea of length, e.g. 1×10^{-6} **mm**	[1]	
		(ii)	unknown effects/absorbed through skin/discolour skin/allergic reaction/damage organs	[1]	
	(c)	**(i)**	A layer [1] of (aluminium) oxide [1] forms on surface of aluminium which prevents aluminium reacting [1]	[3]	
		(ii)	aluminium + copper(II) oxide → aluminium oxide + copper [1] for reactants and [1] for products allow copper oxide for copper(II) oxide	[2]	14
7	**(a)**		$\frac{96\,[1]}{150\,[1]} \times 100 = 64$ [1] %	[3]	
	(b)		colourless [1] to pink [1] award [1] for wrong way round	[2]	
	(c)	**(i)**	pipette	[1]	
		(ii)	burette	[1]	
		(iii)	cannot see **the colour** change of the indicator in red wine	[1]	
	(d)	**(i)**	19.0 [2] cm^3 allow 19[1]cm^3 use of rough gives 19.33 [1]	[2]	
		(ii)	$\frac{19 \times 0.1}{1000}$ [1] $= 0.0019$ [1]	[2]	
		(iii)	$\frac{0.0019}{2}$ [1] $= 0.00095$ (9.5×10^{-4}) [1]	[2]	
		(iv)	$\frac{0.00095 \times 1000}{25}$ [1] $= 0.038$ [1] mol/dm^3	[2]	
		(v)	$0.038 \times 150 = 5.7$ [1] g/dm^3	[1]	17
			Apply consequential marking throughout **(d)**		
				Total	**115**