



Rewarding Learning

**General Certificate of Secondary Education
January 2019**

GCSE Chemistry

Unit 2

Higher Tier

[GCH22]

FRIDAY 25 JANUARY, 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 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, 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 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) anhydrous calcium chloride	[1]
	(ii) hydrated copper(II) sulfate/hydrated cobalt(II) chloride	[1]
	(iii) anhydrous calcium chloride	[1]
	(b) (i) X	[1]
	(ii) Y	[1]
	(iii) Z	[1]
	(iv) $\text{Ca}(\text{HCO}_3)_2 \rightarrow \text{CaCO}_3 + \text{H}_2\text{O} + \text{CO}_2$ correct formula of reactant [1] correct formulae of products [1]	[2]
	(c) (i) hydrated sodium carbonate [1]	[1]
	(ii) Ca^{2+} /calcium ions/ Mg^{2+} /magnesium ions in the water [1] react with CO_3^{2-} /carbonate ions from the washing soda [1] to form insoluble/solid calcium carbonate/magnesium carbonate [1]	[3]
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- 2 (a) (i)
$$\begin{array}{c} \text{H} \quad \text{H} \\ | \quad | \\ \text{C} = \text{C} \\ | \quad | \\ \text{H} \quad \text{H} \end{array}$$
 [1]
- (ii) C_2H_4 [1]
- (iii) C_nH_{2n} [1]
- (iv) bubble into/shake with bromine water [1]
orange [1] to colourless [1] [3]
- (b) (i)
$$\begin{array}{c} \text{H} \\ | \\ \text{H} - \text{C} - \text{C} \begin{array}{l} // \text{O} \\ \backslash \text{OH} \end{array} \\ | \\ \text{H} \end{array}$$
 [1]
- (ii) a long chain molecule [1]
- (iii)
$$\begin{array}{c} \text{F} \quad \text{F} \\ | \quad | \\ \text{C} = \text{C} \\ | \quad | \\ \text{F} \quad \text{F} \end{array}$$
 [1]
- (c) (i) sugar solution and yeast [1]
warm [1]
absence of air/anaerobic [1]
produces ethanol and carbon dioxide [1] [4]
- (ii)
$$\begin{array}{c} \text{H} \quad \text{H} \\ | \quad | \\ \text{H} - \text{C} - \text{C} - \text{OH} \\ | \quad | \\ \text{H} \quad \text{H} \end{array}$$
 [1]
- (iii) $\text{C}_2\text{H}_5\text{OH} + 3\text{O}_2 \rightarrow 2\text{CO}_2 + 3\text{H}_2\text{O}$
correct formulae of reactants [1]
correct formulae of products [1]
correct balancing [1] [3]
- (d) (i) OH [1]
COOH [1] [2]
- (ii) $\text{C}_4\text{H}_6\text{O}_5$ [1]
- (iii) any **two** from:
bubbles/effervescence/gas produced
heat released
solid or sodium carbonate disappears
colourless solution formed [2]
- (iv) partially dissociates in water [1]

AVAILABLE
MARKS

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		AVAILABLE MARKS
3 (a) (i)	circle round hydrogen; oxygen; carbon dioxide	[1]
(ii)	$2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2$ correct formula of reactant [1] correct formulae of products [1] correct balancing [1]	[3]
(iii)	manganese(IV) oxide	[1]
(b) (i)	$99\text{s} \pm 2$	[1]
(ii)	$0.0101 \text{ (s}^{-1}\text{)}$	[1]
(iii)	starts at 0,0 [1] stays above line [1] levels off at same gas volume but earlier [1]	[3]
(iv)	rate increases [1] more particles [1] more successful collisions [1] in a given period of time/per second/per minute [1]	[3]
		14

- 4 (a) (i) hydrogen [1]
- (ii) 450°C [1]
200 atm [1] [2]
- (iii) iron [1]
- (b) (i) $2\text{NH}_3 + \text{H}_2\text{SO}_4 \rightarrow (\text{NH}_4)_2\text{SO}_4$
correct formulae of reactants [1]
correct formula of product [1]
correct balancing [1] [3]
- (ii) nitric acid [1]
- (iii) idea of nitrates leaching into rivers and lakes [1]
excess algae growth [1]
death of algae [1]
decomposing microorganisms use up oxygen gas in the water [1]
death of fish [1] [4]
Max 4 out of 5

(c)

Observation on the addition of 1 cm ³ of ammonia solution	Observation on the addition of excess ammonia solution	Metal ion present in solution
white precipitate	white precipitate dissolves to form a colourless solution	Zn ²⁺ [1]
blue precipitate	(blue) precipitate dissolves to form a deep blue/dark blue solution [1]	Cu ²⁺
green precipitate	green precipitate remains	Fe ²⁺ [1]
white precipitate	(white) precipitate remains [1]	Mg ²⁺

[4]

AVAILABLE
MARKS

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5 (a)

Reaction	Exothermic	Endothermic
Rusting	✓	
Combustion of methane	✓ [1]	
Thermal decomposition of calcium carbonate		✓ [1]

[2]

(b) (i) hydrated iron(III) oxide [1] [1]

(ii) brown/orange [1] flaky [1] solid [1] **max** [2]

(iii) iron loses electrons [1]
 loss of electrons is oxidation [1]
 oxygen gains electrons [1]
 gain of electrons is reduction [1]
 redox is oxidation and reduction occurring simultaneously/in same reaction/at the same time [1] [5]

(c) (i)

Object	Oiling	Painting	Galvanising
Bridge		✓ or	✓ [1]
Bicycle chain	✓	or	✓ [1]

[2]

(ii) zinc [1]

(d) (i) sacrificial protection [1]

(ii) magnesium is more reactive than iron [1]
 magnesium reacts first [1] [2]

AVAILABLE
MARKS

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- 6 (a) (i) A = delivery tube [1]
B = gas jar [1] [2]
- (ii) to generate steam [1]
- (iii) hydrogen [1]
- (iv) copper/silver/gold [1]
- (b) (i) $\text{Fe} + \text{CuSO}_4 \rightarrow \text{FeSO}_4 + \text{Cu}$
correct formulae of reactants [1]
correct formulae of products [1] [2]
- (ii) displacement/redox [1]
- (c) (i) iron ore/haematite [1]
coke [1] [2]
- (ii) C = hot air [1]
D = molten slag [1]
E = molten iron [1] [3]
- (iii) carbon dioxide/carbon monoxide/nitrogen [1]
- (iv) **Indicative content**
thermal decomposition of CaCO_3 /limestone/calcium carbonate [1]
 $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$ [2]
silicon dioxide/ SiO_2 /sand is the (acidic) impurity [1]
 $\text{CaO} + \text{SiO}_2 \rightarrow \text{CaSiO}_3$ [2]
molten slag/calcium silicate tapped off [1]

Response	Mark
Candidates must use appropriate specialist terms to explain fully the removal of acidic impurities including the balanced symbol equations (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 the removal of acidic impurities (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 the removal of acidic impurities (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]

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7 (a) (i) Indicative content

safety	<ul style="list-style-type: none"> • pipette filler used • safety glasses
rinse	<ul style="list-style-type: none"> • pipette rinsed with deionised water • pipette rinsed with vinegar solution
filling	<ul style="list-style-type: none"> • fill with vinegar solution • until bottom of the meniscus is on the line
transfer	<ul style="list-style-type: none"> • release into conical flask • touch tip of pipette onto surface of liquid

Response	Mark
Candidates must use appropriate specialist terms throughout to discuss fully the preparation and use of a pipette with regard to safety in a logical sequence (7–8 points). 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 discuss the preparation and use of a pipette with regard to safety (3–6 points). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
Candidates describe the preparation and use of a pipette with regard to safety which may not be in a logical sequence (using a minimum of 2 points). They use limited spelling, punctuation and grammar and form and style are of a limited standard.	[1]–[2]
Response not worthy of credit	[0]

[6]

(ii) colourless [1] to pink [1]
(wrong way round award [1])

[2]

(b) (i) $\frac{22.5 \times 0.14}{1000}$ [1] = 0.00315 [1]

[2]

(ii) 0.00315 [1]

[1]

(iii) $0.00315 \times 40 = 0.126$ [1]

[1]

(iv) 0.126×60 [1] = 7.56 [1]

[2]

14

Total**115**