Rewarding Learning

General Certificate of Secondary Education
2018

GCSE Chemistry

Unit 2

Higher Tier

[GCH22]

WEDNESDAY 20 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)** contains **only** carbon and hydrogen (atoms) [1]

(ii) B ethane [1]
D ethene [1]
F propene [1] [3]

(iii) C_3H_8 [1]

(iv) $C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$
correct formulae of reactants [1]
correct formulae of products [1]
correct balancing [1] [3]

(v) alkanes [1]

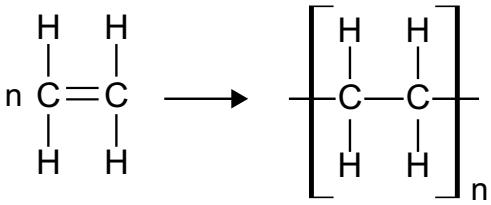
(vi) C_nH_{2n} [1]

(vii) D and F [1]

(viii) carbon monoxide [1]
water [1]
soot [1] [3]

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

(ii)

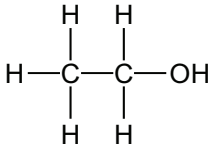


correct monomer structure [1]
correct polymer structure with bonds through brackets [1]
n shown before monomer and after polymer structure [1] [3]

(iii) polythene/poly(ethene) [1]

(iv) landfill [1]
incineration [1] [2]

(c) **(i)**



[1]

(ii) orange to green [1]

23

				AVAILABLE MARKS
2	**(a)**	**(i)**	270–275 **s** [1]	
		(ii)	conical flask [1] conical flask on a top-pan balance [1] calcium carbonate and HCl **in contact** in conical flask [1] stopclock [1] [4]	
	(b)		decreases rate [1] particles have less (kinetic) energy/move more slowly [1] fewer successful collisions [1] per second/minute/unit time [1] [4]	9

AVAILABLE MARKS

3 **(a)** **(i)** different forms of the same element [1]
in the same (physical) state [1] [2]

(ii) monoclinic [1] plastic [1] rhombic [1] [3]

(b) **(i)** $2SO_2 + O_2 \rightarrow 2SO_3$
correct formulae of reactants [1]
correct formula of product [1]
correct balancing [1] [3]

(ii) 450 **°C** [1]

(iii) vanadium pentoxide/vanadium(V) oxide [1]

(iv) $SO_3 + H_2SO_4 \rightarrow H_2S_2O_7$
correct formulae of reactants [1]
correct formula of product [1] [2]

(c) **Indicative content**

copper(II) oxide reaction
• copper(II) sulfate [1]
. water **only** [1]

copper(II) carbonate reaction
• copper(II) sulfate [1]
• water [1]
• carbon dioxide [1]

observations for copper(II) carbonate and sulfuric acid
Any 2 from: [2]
- green solid disappears
- blue solution formed
- bubbles/gas produced/fizzing/effervescence

observations for copper(II) oxide and sulfuric acid
Any 1 from: [1]
- black solid disappears
- blue solution formed

(any incorrect observation, e.g. bubbles, loses this mark)

Response	Mark
Candidates must use appropriate specialist terms to fully compare 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 must use appropriate specialist terms to compare 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 these two reactions (using 2–3 points of indicative content). They use limited spelling, punctuation and grammar and they make 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)** removes water [1]

(ii) sugar [1] white solid [1] to black solid [1]
or hydrated copper(II) sulfate [1] blue solid [1] to white solid [1] [3]

AVAILABLE MARKS

22

AVAILABLE MARKS

4 **(a)** **(i)** boiling removes oxygen/no oxygen or air in boiled water [1]
oil stops oxygen re-entering [1] [2]

(ii) (anhydrous) calcium chloride removes water [2] [2]
(no water/water has been removed from the air [1])

(iii) limited supply of air/less oxygen in test tube 2/not a limited supply of air/oxygen in test tube 1 [1]

(iv) hydrated [1] iron(III) oxide [1] [2]

(b) **(i)** any **two** from:
painting
metal coating/plating
plastic coating
oil/grease
galvanising [2]

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

(iii) zinc [1]

(c) iron loses electrons [1]
loss of electrons is oxidation [1] [2]

(d) **(i)** $SO_2 + 2CO \rightarrow S + 2CO_2$
correct formulae of reactants [1]
correct formulae of products [1]
correct balancing [1] [3]

(ii) **Indicative content**
- exothermic = gives out heat [1]
- energy is taken in when bonds are broken [1]
- bonds are broken in sulfur dioxide (and carbon monoxide) [1]
- energy is released when bonds are formed [1]
- bonds form in (sulfur and) carbon dioxide [1]
- more energy released than taken in [1]

Response	Mark
Candidates must use appropriate specialist terms to fully explain the exothermic nature of this reaction (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 must use appropriate specialist terms to explain the exothermic nature of this reaction (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 exothermic nature of this reaction (using at least 2 points of indicative content). They use limited spelling, punctuation and grammar and they make little use of specialist terms. The form and style are of a limited standard.	[1]–[2]
Response not worthy of credit	[0]

[6]

23

AVAILABLE MARKS

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

(ii) any **two** from:
calcium metal sinks (and then rises)
gas produced/bubbles/fizzing
heat released
calcium/metal disappears
turns cloudy/milky [2]

(b) **(i)** magnesium in a boiling tube [1]
damp mineral wool in boiling tube [1]
heat applied to boiling tube [1]
collection over water to include labels for beehive shelf, trough and water [1]
gas jar/boiling tube to collect gas [1]
delivery tube [1] max [5]

(ii) magnesium oxide [1]

(c) **(i)** water that does not readily form a lather with soap [1]

(ii)

Name of compound	Formula	Temporary or Permanent hardness
Calcium sulfate [1]	$CaSO_4$	**Permanent** } [1]
Calcium hydrogencarbonate	**$Ca(HCO_3)_2$** [1]	**Temporary** }

[3]

(d) **(i)** hydrated sodium carbonate [1]

(ii) calcium ions in the (hard) water [1]
react with the carbonate ions from the washing soda [1]
to form insoluble calcium carbonate [1] [3]

(iii) $Ca^{2+}(aq) + CO_3^{2-}(aq) \rightarrow CaCO_3(s)$
correct formulae of reactants [1]
correct formula of product [1]
correct state symbols [1] [3]

(iv) boiling [1] 23

					AVAILABLE MARKS
6	**(a)**	**(i)**	Yellow/orange [1] to red/orange [1]	[2]	
		(ii)	$\frac{12.5 \times 0.08}{1000}$ [1] = 0.001 [1]	[2]	
		(iii)	$\frac{0.001}{2}$ = 0.0005 [1]	[1]	
		(iv)	0.0005 × 40 = 0.02 [1]	[1]	
		(v)	$\frac{1.48}{0.02}$ [1] = 74 [1]	[2]	
		(vi)	74 – 60 = 14 $\frac{14}{2}$ = 7 [1] lithium [1]	[2]	
	(b)	**(i)**	0.00125 × 2 = 0.0025 [1]	[1]	
		(ii)	$\frac{0.0025 \times 1000}{32.0}$ [1] = 0.078125 [1] mol/dm^3	[2]	
		(iii)	0.078125 × 56 [1] = 4.375 [1] g/dm^3	[2]	15
				Total	**115**