Rewarding Learning

General Certificate of Secondary Education
2013

Science: Chemistry

Unit C2

Higher Tier

[GCH22]

THURSDAY 20 JUNE, AFTERNOON

MARK SCHEME

General Marking Instructions

Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The Purpose of Mark Schemes

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of students in schools and colleges.

The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

					AVAILABLE MARKS
1	(a)	(i)	white	[1]	
		(ii)	$2Mg + O_2 \rightarrow 2MgO$ [1] for correct formulae of reactants [1] for correct formula of product [1] for correct balancing	[3]	
	(b)	(i)	• black solid (at beginning) [1] • flame/glows/sparks [1] appropriate colour [1] • sooty/smoky [1] • (white/grey) ash formed/no solid remaining [1] • heat released [1]	**max** [2]	
		(ii)	carbon monoxide	[1]	
	(c)		$4KNO_3 \rightarrow 2K_2O + 5O_2 + 2N_2$ [1] for correct formula of reactant [1] for correct formulae of products [1] for correct balancing	[3]	
	(d)	(i)	water/moisture [1] air/oxygen [1]	[2]	
		(ii)	hydrated [1] iron(III) oxide [1]	[2]	
	(e)		**iron oxide** loses oxygen [1] reduction is loss of oxygen [1] **carbon monoxide** gains oxygen [1] oxidation is the gain of oxygen [1] redox is oxidation and reduction occurring simultaneously [1]	[5]	19

					AVAILABLE MARKS
2	(a)	(i)	**gas** syringe	[1]	
		(ii)	substance which increases [1] the **rate of a (chemical) reaction** [1] without being used up/without being chemically changed **at the end** [1]	[3]	
		(iii)	$2H_2O_2 \rightarrow 2H_2O + O_2$ [1] for correct formula of reactant [1] for correct formulae of products [1] for correct balancing	[3]	
	(b)	(i)	any second accurate timing device, e.g. (stop)clock/(stop)watch	[1]	
		(ii)	48 (cm^3)	[1]	
		(iii)	starts at (0,0) and remains higher throughout/steeper gradient [1] finishes at same gas volume/48 cm^3 [1] finishes in less time/earlier [1]	[3]	
	(c)	(i)	time is 38–40 [1] rate is 0.02631 to 0.025 [1]	[2]	
		(ii)	zinc oxide [1] largest time/smallest or lowest rate [1] second mark dependent on first mark	[2]	16

AVAILABLE MARKS

3 **(a)** **(i)** (the molecule of myrcene) contains **only** carbon and hydrogen [1]

(ii) C═C [1]

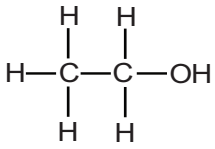
(b) **(i)** OH group identified [1]

(ii) $C_{10}H_{17}OH + 14\ O_2 \rightarrow 10\ CO_2 + 9\ H_2O$
[1] for correct formulae of products
[1] for balancing [2]

(iii) orange [1] to green [1] [2]

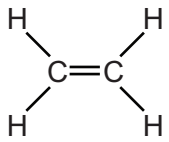
(c) **(i)** $C_nH_{2n+1}OH$ [1]

(ii)



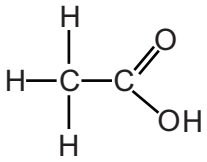
[1]

(iii)

Name	Molecular formula	Structural formula	State at room temperature and pressure
Ethene	C_2H_4 [1]	 [1]	gas [1]

[3]

(d) **(i)**



[1]

(ii) bubbles/effervescence [1]
magnesium disappears [1]
heat released [1]
colourless solution remains [1] **max** [2]

(iii) $Mg + 2CH_3COOH \rightarrow (CH_3COO)_2Mg + H_2$ [3]

18

					AVAILABLE MARKS
4	(a)	(i)	A delivery tube [1] B gas jar [1]	[2]	
		(ii)	generate steam	[1]	
		(iii)	hydrogen	[1]	
		(iv)	copper/silver/gold/platinum/palladium	[1]	
	(b)	(i)	copper	[1]	
		(ii)	any **three** from: floats/on surface moves about melts to form a silvery ball fizzing/gas produced colourless solution formed metal disappears heat released	[3]	
		(iii)	$2Na + 2H_2O \rightarrow 2NaOH + H_2$ [1] for correct formulae of reactants [1] for correct formulae of products [1] for correct balancing	[3]	
	(c)	(i)	decomposition [1] using (a direct current of) electricity [1]	[2]	
		(ii)	alumina	[1]	
		(iii)	$Al^{3+} + 3e^- \rightarrow Al$ [1] for Al^{3+} and e^- on left hand side [1] for Al on right hand side [1] for correct balancing of electrons	[3]	
		(iv)	900–1000 °C	[1]	
		(v)	anode/carbon reacts with oxygen [1] forming carbon dioxide [1] carbon anodes are worn away [1]	[3]	22

AVAILABLE MARKS

5 (a) Indicative content

safety
- pipette filler used

rinse
- pipette rinsed with (deionised) water
- pipette rinsed with MOH solution

filling
- fill with MOH solution
- until **bottom of meniscus** on the line

transfer
- release into conical flask
- touch tip of pipette onto surface of liquid

Accept alternative appropriate responses

Response	Mark
Candidates must use appropriate specialist terms throughout to discuss fully the preparation and use of a pipette with regard to safety and accuracy in a logical sequence **(6–7 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 and accuracy **(3–5 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 and accuracy 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]

(b) (i) 14.0 [2] [2]
award [1] for 14.3 which includes use of rough titration value

(ii) pink [1] to colourless [1] [2]
(wrong way round [1])

(iii) $\frac{14 \times 0.125}{1000}$ [1] = 0.00175 [1] [2]

(iv) 0.00175 [1]

(v) 0.00175 × 40 [1] = 0.07 [1] [2]

(vi) $\frac{3.92}{0.07}$ [1] = 56 [1] [2]

(vii) OH = 17 [1]
M = 56 – 17 = 39 [1] [2]

(viii) potassium/K [1]

20

					AVAILABLE MARKS
6	(a)	(i)	C	[1]	
		(ii)	B	[1]	
		(iii)	C	[1]	
	(b)		Ca^{2+}/calcium ions/Mg^{2+}/magnesium ions react [1] reaction with CO_3^{2-}/carbonate ions [1] forming insoluble/solid $CaCO_3$/magnesium carbonate [1]	[3]	
	(c)		• wastes soap • produces limescale in kettles/hot water pipes/irons etc. • qualified cost (more electricity used, purchase of ion exchanger/ dishwasher salt) • forms scum with soap	**max** [2]	8
7	(a)	(i)	$NH_3 + HNO_3 \rightarrow NH_4NO_3$	[2]	
		(ii)	dip glass rod [1] into concentrated hydrochloric acid [1] apply to gas white [1] smoke/solid [1]	[4]	
		(iii)	blue baby syndrome/stomach cancer/eutrophication	[1]	
	(b)	(i)	idea that reaction can move from right to left as well as from left to right	[1]	
		(ii)	iron	[1]	
	(c)	(i)	decreases	[1]	
		(ii)	30%	[1]	
		(iii)	compromise between temperature and pressure/rate and yield/ catalyst does not work at low temperatures/pressure expensive to apply	[1]	12
				Total	**115**