



GCSE MARKING SCHEME

JANUARY 2016



**SCIENCE – CHEMISTRY C1
4462/ 01/02**

INTRODUCTION

This marking scheme was used by WJEC for the January 2016 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

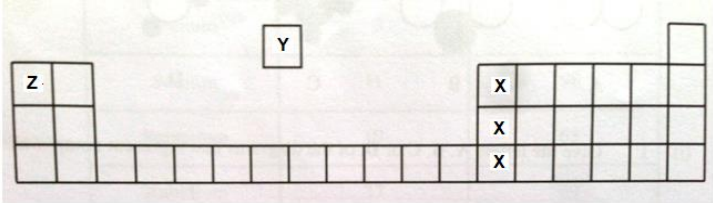
Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT							
1		(a)	(i)	1	electron			
			(ii)	1	nucleus			
		(b)	(i)	1	CH ₄	H ₄ C		
			(ii)	1	 ignore relative sizes			
		(c)	(i)	1	1			
			(ii)	1	6			

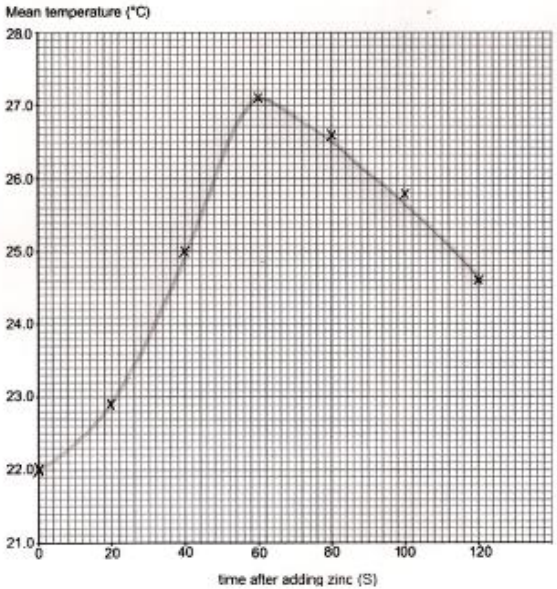
Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
2		(a)			2	oxygen (1) carbon dioxide (1)	O ₂ CO ₂	O	
		(b)	(i)		3	B (1) C (1) A (1)		all references to animals, plants or fossil fuels	
			(ii)		1	global warming		greenhouse effect / climate change	

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
3		(a)	(i)		1	lithium oxide			
			(ii)		1	lithium and oxygen – both required		Li and O	oxide
		(b)			2	iodine, I ₂ , is a compound (1) the symbol for iron is FE (1)	accept any indication of the incorrect statements		
		(c)	(i)		2	D (1) Do not conduct electricity and is not shiny (1)	C for (1) if linked to not conducting electricity		
			(ii)		2	B (1) it conducts electricity but does not react with water – both needed (1)	is a metal but does not react with water	does not react with water	

Question Number																																
FT	HT	Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept																								
4		(a)		1	<table border="1"> <thead> <tr> <th>Group</th> <th colspan="3">volume of sodium hydroxide solution needed to neutralise the hydrochloric acid (cm³)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>24.2</td> <td>24.8</td> <td>24.7</td> </tr> <tr> <td>2</td> <td>24.6</td> <td>24.8</td> <td>24.7</td> </tr> <tr> <td>3</td> <td>25.1</td> <td>25.3</td> <td>25.8</td> </tr> <tr> <td>4</td> <td>24.5</td> <td>24.5</td> <td>24.5</td> </tr> <tr> <td>5</td> <td>24.9</td> <td>25.0</td> <td>25.1</td> </tr> </tbody> </table> <p>both needed</p>	Group	volume of sodium hydroxide solution needed to neutralise the hydrochloric acid (cm ³)			1	24.2	24.8	24.7	2	24.6	24.8	24.7	3	25.1	25.3	25.8	4	24.5	24.5	24.5	5	24.9	25.0	25.1			
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3	25.1	25.3	25.8																													
4	24.5	24.5	24.5																													
5	24.9	25.0	25.1																													
		(b)		2	pH will increase / go up / rise (1) green (1)	correct reference to pH numbers e.g. go from 1/2 to 7	pH will be 7																									
		(c)	(i)	1	water	H ₂ O		acid																								
			(ii)	1	sodium chloride	NaCl	common salt																									
		(d)		1	sodium sulfate water – both needed	Na ₂ SO ₄ H ₂ O																										

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept	
FT	HT									
5		(a)	(i)	I	1	kerosene	paraffin	150 to 250 11 - 15		
				II	1	petrol		20 to 100 4 - 12		
			(ii)		1	11 or 12	both correct answers	named fractions		
			(iii)		1	the greater the number of carbon atoms, the higher the boiling point	any expression of 'longer chain = higher boiling point'	it increases		
		(b)	(i)			4	C / burn them (with other waste) (1) releases toxic / poisonous fumes (1)	CO ₂ released causing global warming etc. smell / leakage / spoils landscape	dangerous fumes / reference to acid rain dangerous to animals / non-biodegradable	
							B / send to landfill with other waste (1) insufficient / limited space (1)			
	(ii)			2	waterproof (1) stronger / more durable / doesn't tear / doesn't rip (1)		reference to colour / recycling / flexibility / biodegradability			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
6	1	(a)			3	 <p>award (1) for each of X, Y and Z</p>			
		(b)			2	<p>similarity – arranged in groups / periods (1)</p> <p>difference – he had gaps / missing groups / more than one element in some spaces / arranged by mass not atomic number (1)</p>	more elements today	reference to shape	arranged by mass/atomic number as a similarity
		(c)		(i)	1	CaO	Ca ²⁺ O ²⁻ / OCa		
				(ii)	1	Mg(OH) ₂	Mg ²⁺ (OH) ⁻ ₂ / Mg(HO) ₂ / (OH) ₂ Mg		

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT							
7	2	(a)		1	26.9	answer in table		
		(b)		3	 <p>all points plotted correctly (2) 5 or 6 points plotted correctly (1)</p> <p>suitable line – must be curve going up (1)</p>			
		(c)		2	22 (1) will return to room / starting temperature (1)	any value between 22.0 and 22.9	room temperature	

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT							
7	2	(d)		2	any two of the following for (1) each <ul style="list-style-type: none"> • both sets of results showed the same pattern • repeated results are close together / consistent / similar • all results used in calculating averages / no anomalous results • plotted points are all close to the smooth curve 		any reference to fair test	
		(e)		2	heat loss / insufficient insulation (1) put a lid on the cup / wrap in cotton wool or foil (1)	sensible alternative insulation method e.g. cup inside another cup	reference to stirring	
		(f)		1	$\text{Zn} + \boxed{2} \text{AgNO}_3 \rightarrow \text{Zn}(\text{NO}_3)_2 + \boxed{2} \text{Ag}$			

Question Number		Mark	Answer
FT	HT		
8	3	6	<p>Indicative content</p> <ul style="list-style-type: none"> • the Earth's crust is made up of huge pieces called tectonic plates • these plates are continually moving due to convection currents in the mantle • plate movement causes continents to move <p>Relevant detail relating to any one of the following types of boundary; they do not have to be named</p> <p><u>Constructive boundary</u></p> <ul style="list-style-type: none"> • plates move apart • magma rises into the gap • cools and solidifies • new igneous rock is formed <p><u>Conservative boundary</u></p> <ul style="list-style-type: none"> • plates move in opposite directions (side by side) • they overcome friction and move suddenly • earthquake activity • rocks are deformed <p><u>Destructive boundary</u></p> <ul style="list-style-type: none"> • plates move towards each other • denser plate sinks and melts (destroyed) • less dense plate rises up forming mountain ranges (deformed) • any other relevant point e.g. subduction zone / volcanoes

Question Number		Mark	Answer
FT	HT		
8	3	6	<p>5-6 marks: The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.</p> <p>3-4 marks: The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.</p> <p>1-2 marks: The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.</p> <p>0 marks: The candidate does not make any attempt or give a relevant answer worthy of credit.</p>

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	4	(a)			2	potassium (1) 100 °C is above the melting point but below the boiling point (1)	K between the melting point and boiling point		
		(b)			2	carbon – high melting point / boiling point (for a non-metal) (1) iodine – shiny (1)		melting point / boiling point appearance	
		(c)			2	chromium (1) high melting point and shiny / malleable (1)	melting point higher than 800 °C is equivalent to 'high melting point'	reference to boiling point or ductility	

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	5	(a)	(i)		1	splitting a compound using electricity	separating the elements in a compound		
			(ii)		2	to lower the melting point of aluminium oxide (1) less heat energy needed to melt it (1)			
			(iii)		1	<input type="text" value="2"/> Al ₂ O ₃ → <input type="text" value="4"/> Al + <input type="text" value="3"/> O ₂			
		(b)			3	saving = £256.50 (3) if answer incorrect award (1) each for up to two correct steps with error carried forward throughout cost of extraction = £285 (1) 10% of cost = £28.50 (1) saving = £256.50 (1)	90/100 x £285 as alternative method		

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT							
	6	(a)		3	<p>does not support the argument / supports and contradicts the argument / unable to say whether it supports the argument (1)</p> <p>any two of following for (1) each – opinion must be given</p> <ul style="list-style-type: none"> • there is no correlation /pattern between the level of fluoridation and DMFT • the countries with the lowest fluoridation have both the highest and lowest DMFT • the country with the highest fluoridation did not have the least DMFT • countries with the same/ similar fluoridation do not have the same DMFT 	named countries or DMFT values in answers		supports the argument
		(b)		2	<p>any two of following for (1) each</p> <ul style="list-style-type: none"> • mass medication / removes freedom of choice • can get fluoride from elsewhere / from toothpaste etc. • increased chance of fluorosis / discolouring of teeth • increased chance of stomach cancer (or other related condition or illness) 		no proof that it has a beneficial effect / evidence inconclusive reference to cost	

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	7	(a)			4	<p>carbon dioxide level decreased (1) photosynthesis in plants / absorbed into (carbonate) rocks in sea (1)</p> <p>water vapour level decreased (1) atmosphere cooled and condensed (to form the oceans) (1)</p>		Earth cooled	
		(b)			3	<p>photosynthesis takes in carbon dioxide and gives out oxygen – both needed (1)</p> <p>respiration takes in oxygen and gives out carbon dioxide – both needed (1)</p> <p><i>final mark may only be credited when first two marks are awarded</i></p> <p>opposite processes balance each other out / result in no overall change / maintain levels of both gases (1)</p>	award (1) for reference to both processes and only one of the gases		

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT	(c)	(i)						
	7				3	<p>emissions from China are increasing more / at a faster rate than those from the USA (1)</p> <p>USA emissions have increased gradually / approximately doubled / gone from c.800 to c.1600 million tonnes (1)</p> <p>China emissions have increased dramatically / increased by approximately 20 times (1)</p>	USA emissions are higher at the start but China emissions are higher at the end (1)	both are increasing	
			(ii)		2	<p>fossil fuel use has risen / burning more fossil fuels (1)</p> <p>more carbon dioxide has led to more heat being trapped / increased greenhouse effect (1)</p>		reference to higher temperatures	

Question Number		Mark	Answer
FT	HT		
	8	6	<p><u>Indicative content</u></p> <ul style="list-style-type: none"> • add acid to each solution in turn • acid reacts with NaOH and Na₂CO₃ but not with NaCl • no temperature rise or fizzing with NaCl • temperature rises with NaOH and Na₂CO₃ • greater temperature rise with NaOH than with Na₂CO₃ • fizzing seen with Na₂CO₃ but not with NaOH • products named for given reactions • relevant equations (word and/or balanced symbol equations) <p>5-6 marks: The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.</p> <p>3-4 marks: The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.</p> <p>1-2 marks: The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.</p> <p>0 marks: The candidate does not make any attempt or give a relevant answer worthy of credit.</p>