



GCSE MARKING SCHEME

SCIENCE - CHEMISTRY

SUMMER 2012

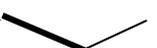
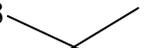
INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2012 examination in GCSE SCIENCE-CHEMISTRY. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were 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 conferences was to ensure that the marking schemes were 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' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

C1

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
1		(a)	(i)	2	high mp / high bp / high density any 2 for (1) each all properties must have high values (2)		reference to numerical values	
			(ii)	2	tin (1) low mp and high bp / low mp and high density (1)			
		(b)		2	diag 1  description 1 diag 2  description 2 diag 3  description 3 diag 4  description 4 all correct (2) any 1 correct (1)			

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT	(a)	(i)						
2			(i)		1	breaking down/splitting a compound (into its elements) using an electric current/electricity both statements needed			
			(ii)		1	water	H ₂ O		
			(iii)		2	it contains hydrogen and oxygen (1) the ratio of H:O is 2:1 (1)	it contains H and O there is twice as much hydrogen than oxygen - 2 marks	there is more hydrogen than oxygen	it contains H ₂ and O ₂
		(b)			2	water (1) contains two different atoms (joined together) / contains two elements (joined together) (1)	H ₂ O or diagram contains both elements		

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
3		(a)	(i)		2	<p>both Al³⁺ ions are shown going to the negative electrode (1)</p> <p>all three O²⁻ ions are shown going to the positive electrode (1)</p>	one Al ³⁺ and one O ²⁻ for (1)		
			(ii)		1	2:4:3			
		(iii)		1	gains 3 electrons			gains electrons	
		(b)		2	<p>aluminium (1)</p> <p>very good(electrical)conductor <i>.....this answer required, plus either</i></p> <p>low density <i>or</i> (good) resistance to corrosion (1) both needed</p> <p>aluminium not identified but two correct properties given (1)</p>	low density = light			

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT		(i)						
4		(a)	(i)		2	filter (1) leave to <i>evaporate</i> (at room temperature) / leave in a basin on the side of the laboratory to <i>evaporate</i> / <i>evaporate</i> (some) water away and then leave to evaporate at room temperature / <i>boil</i> (some) water away and leave on the side of the laboratory any one for (1)	filtration <i>heat</i> water away and leave on the side of the laboratory		
			(ii)		1	limewater turns milky			
			(iii)		1	zinc oxide / zinc hydroxide	ZnO Zn(OH) ₂		zinc
		(b)	(i)		1	1			
			(ii)		1	7			

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT	(a)	(i)	I	1	C ₁₃ -C ₁₆			
				II	1	C ₉ -C ₁₂		reference to diesel	
			(ii)		1	cracking			
		(b)			2	<p>to reduce usage/make people use them again</p> <p>plastic (bags) are non-biodegradable / plastic (bags) take a long time to rot / plastic (bags) take a long time to decompose / plastic (bags) take a long time to break down</p> <p>reduce landfill</p> <p>conserves crude oil</p> <p>any two for (1) each</p>		<p>reference to recycling</p> <p>reference to raising money/ littering/pollution</p> <p>reduce waste</p> <p>conserves raw materials</p>	

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
6		(a)	(i)		2	aluminium / Al zinc / Zn iron / Fe copper / Cu (1) more bubbles = more reactive (1)	converse		
			(ii)		1	iron sulfate + hydrogen both needed	FeSO ₄ + H ₂		H hydrogen <i>gas</i> iron sulphate <i>solution</i>
			(iii)		1	(sulfuric acid) is the acid found in acid rain / (sulfuric acid) causes acid rain			
			(iv)		1	1. damages marble statues 2. destroys forests both needed	correct statements identified in any way		
		(b)	(i)		1	decreases			‘decreases <i>then stays the same</i> ’
			(ii)		1	more industry / factories more coal power stations <i>‘source’ needed not ‘reason’</i>	more combustion of fossil fuels	more people / cars ‘developing countries’	

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
7	1	(a)		2	melting point decreases (1) density increases (1)			
		(b)		1	potassium	K		sodium
		(c)		2	values from 669–650°C (1) (francium boiling point) below that of caesium /boiling points decrease down the group below 670°C and above 650°C / no greater than 20°C below caesium’s boiling point (1)			

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT							
8	2	(a)		2	Iceland (1) positioned on the mid-Atlantic ridge / mid-Atlantic ridge passes through Iceland / positioned at a boundary where plates are moving apart / on constructive plate boundary			
		(b)	(i)	1	rocks furthest away (from the plate boundary) are the oldest			
			(ii)	2	new (igneous) rock formed (1) ocean floor moving / ocean floor spreading / rocks moving away from boundary / plates moving apart (1) constructive plate boundary (1) any 2 for (1) each	ocean floor = sea floor floor = rocks	new 'land' formed	plates move towards/past each other

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
9	3	(a)	(i)	1	circle around 3.0			
			(ii)	1	incorrect <i>mass of magnesium</i> used / incorrect <i>volume of copper(II) sulfate solution</i> used / thermometer <i>out of the reaction</i> mixture when read any one		too much magnesium added	incorrect thermometer reading
		(b)		3	all points plotted correctly (2) one plotting error only (1) smooth curve of best fit (by eye) (1) (<i>line must be a single line and line must go to origin</i>)			points joined by straight lines
		(c)		1	no magnesium added = no temperature rise/ no magnesium added = no reaction			
		(d)		2	0.8(g) (1) consequential from graph temperature stops rising /graph stops rising (1)			

Question Number		Mark	Answer
FT	HT		
10	4	6	<p>Indicative content: Reference to the <i>causes, consequences</i> and <i>solutions</i> of global warming e.g.</p> <p>QWC Causes: burning fossil fuels / named fuels deforestation CO₂ in atmosphere increases CO₂ prevents heat escaping from atmosphere/ CO₂ is a greenhouse gas increased greenhouse effect = global warming/increase in atmospheric temperature</p> <p>Consequences: sea level increasing/ climate change/ extreme weather event/ increase in melting glaciers, sea ice & permafrost</p> <p>Ways of reducing impact: burn less fossil fuel/ reduce deforestation / alternative energy / reduce use of electricity (personal level) carbon capture and storage</p> <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		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT	(a)	(i)		1	C	Mg		
	5		(ii)		2	(good) electrical conductor (good) thermal conductor malleable / bends ductile / can be stretched into wire high mp / high bp high density hard shiny sonorous any two for 1 mark each	good conductor (1) thermal = heat dense	strong/durable	
			(iii)	I	1	D			
				II	1	brittle and yet has a high mp brittle and yet has a high bp brittle and yet is shiny has both metallic and non-metallic properties found on the boundary between metals and non-metals has intermediate properties any one	metalloid	reference to Group 4	
		(b)			1	(left) gaps			

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
	6	(a)	(i)		1	decreases			
			(ii)		3	2.5 (accept range $2.4-2.6$) $- 2.2 = \mathbf{0.3}$ (1) 0.3/2.5 (1) <i>consequential marking</i> $0.3/2.5 \times 100 = \mathbf{12\%}$ (1) <i>consequential marking</i>			
		(b)	(i)		3	coal contains sulfur (1) sulfur burns forming sulfur dioxide (1) SO₂ reacts with rain (water) forming (acid rain) (1)		reference to CO ₂ and/or oxides of nitrogen	
			(ii)		1	use coal containing less sulfur / use sulfur scrubbers/neutralise the SO ₂ before it leaves the power station		Use less coal/ power coal/ trap SO ₂	use alternative energy resources

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT	(a)		3	<p>O₂ appears/increases and CO₂ decreases both needed (1)</p> <p>plants give out O₂ and plants take in CO₂ both needed (1)</p> <p>photosynthesis / evolution of green plants (1)</p> <p>CO₂ dissolved in oceans (1)</p> <p>any 3 for (1) each</p>			
		(b)		2	<p>nitrogen: 78-80</p> <p>oxygen: 20-21</p> <p>carbon dioxide: 0.03-0.04</p> <p>all three correct (2)</p> <p>any two correct (1)</p>			

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT	(a)	(i)		2	A = sodium carbonate / carbonate B = sodium hydroxide / hydroxide C = sodium chloride / chloride all correct (2) any one (1)	Na_2CO_3 / CO_3^{2-} NaOH / OH^- NaCl / Cl^-		
			(ii)		1	correct balancing 2 HCl and 2 NaCl			
		(b)			1	$\text{Cu}(\text{NO}_3)_2$	$\text{Cu}^{2+}(\text{NO}_3)_2$		

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT							
	9	(a)		2	<p>for shorter chains (C₁- C₁₆) demand > supply (1)</p> <p>for longer chains (C₁₇ – C₂₈) demand < supply (1)</p>			
		(b)		2	<p>(cracking) is the breaking down of large chains/molecules/hydrocarbons into smaller ones (1)</p> <p>reduce unwanted fractions / use up less useful fractions/use up large chains</p> <p>make more useful fractions/ make more smaller chains / make more petrol / make more diesel / makes monomers (for polymerisation)</p> <p>more demand for smaller chains</p> <p style="text-align: right;">any one for 1 mark</p>	example such as decane broken down to octane and ethene		

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT	(a)		1	saves energy / reduces amount of electricity consumption (for melting aluminium oxide)		reference to electrolysis e.g. reduces amount of electricity for electrolysis reference to power/heat	
	10	(b)		1	(ions) <i>attracted</i> to <i>oppositely</i> charged electrodes	opposite charges attract		
		(c)		1	correct balancing 2 O ²⁻ and 4 e ⁻			

Question Number		Mark	Answer
FT	HT		
	11	6 QWC	<p>Indicative content: Reference to <i>raw materials, reactions</i> and <i>products</i> e.g.</p> <p>Raw materials:</p> <ul style="list-style-type: none"> • Iron ore: source of iron • Coke: acts as a fuel/ burns/ forms carbon monoxide/ forms carbon dioxide • Limestone: removes impurities / forms slag • Air: source of oxygen <p>Reactions:</p> <ul style="list-style-type: none"> • coke/C burns forming CO/CO₂ • C/CO reacts with iron oxide forming iron / iron oxide reduced by C/CO • limestone decomposes forming lime / lime reacts with impurities <p>Products : molten iron and slag</p> <p style="text-align: right;"><i>Correct word and symbol equations will satisfy indicative content. Labelled diagram can be used to supplement written answer.</i></p> <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>

C2

Foundation Tier

Q.1	Mark	Answer	Accept	Neutral answer	Do not accept
a i	1	A and C (both needed)			
ii	1	Y contains three substances /Y does not contain A,B or C			
b	2	$\frac{6}{10}$ (1) = 0.6 (1)			

Q.2	Mark	Answer	Accept	Neutral answer	Do not accept
a i	1	2.8.1			
ii	1	3			
iii	1	4			
iv	1	D			
v	1	proton			
b i	2	$40 + 12 + 3(16)$ (1) = 100 (2) - two marks for correct answer			
ii	2	$\frac{40}{100} \times 100$ (1) = 40 (2) - two marks for correct answer	consequential marking		

Q.3	Mark	Answer	Accept	Neutral answer	Do not accept
a i	1	nitrogen	N ₂	N	
ii	1	simple covalent	simple molecular	covalent	
iii	1	nitrogen/graphite	N ₂ /C	N	
b	2	high melting point/good conductor of heat/malleable – any two for 1 mark each		good conductor	
c	1	C			

Q.4	Mark	Answer	Accept	Neutral answer	Do not accept
a i	3	all seven points plotted correctly (2) one error (1) two or more errors (0) smooth curve going through the reliable points (not 92-30) (1)			
ii	2	49 (from graph) (1) graph levels/reaches 120 or highest volume of gas (1)			
iii	2	between 0 and 10 (1) steepest slope/most gas given off in 10 seconds (1)			
b	2	using powdered calcium carbonate/increasing the temperature/increasing the concentration of the acid – any two for one mark each		catalyst	more acid
c	1	no solid left at the end of the experiment/all the solid used up	increase in the volume of gas given off		acid left at the end of the experiment

Q.5	Mark	Answer	Accept	Neutral answer	Do not accept
a i	1	C_3H_6			
ii	1	B			
iii	1	C			
b	1	$ \begin{array}{cccc} & H & H & H & H \\ & & & & \\ H & - C & - C & - C & - C - H \\ & & & & \\ & H & H & H & H \end{array} $			
c	3	heat/ (1) PVC would melt/soften/loose shape (1) melamine no change/char (1) or warm/place in hot water(1) PVC would soften/ loose shape (1) melamine no change(1)		burn	

Q.6	Mark	Answer	Accept	Neutral answer	Do not accept
a	1	screen/tongs/small piece of lithium/large volume of water – any one			laboratory coat
b	2	lithium hydroxide (1) hydrogen (1)	LiOH (1) H ₂ (1)	H	
c	1	lithium (1)	Li		
d	2	burns/lilac flame spits (more) melts moves faster fizzes more – any two for 2 marks	disappears quicker	dissolves quicker	

Q.7	Mark	
	6	<p>Indicative content: Description – heating the mixture in the flask to produce hot vapours. In the condenser the water enters at the lower end of the condenser and leaves at the higher point. The hot vapours from the flask then enter the condenser where they then cool, condense and runs down into the beaker as liquid. Explanation - since the boiling point of ethanol is lower than that of water the vapours will initially contain mainly ethanol and will therefore enter the condenser/beaker first.</p> <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>

Q.8	Mark	Answer	Accept	Neutral answer	Do not accept
a	1	sodium	Na		
b	3	Na + Cl ₂ (1) NaCl (1) correct balancing (1)	consequential marking		
c	2	add silver nitrate solution (1) white precipitate/solid formed (1)			

Q.9	Mark	Answer	Accept	Neutral answer	Do not accept
a	1	6 and 2 – both needed			
b i	1	B	oxide/O ²⁻	oxygen/O	
ii	1	2-	O ²⁻		
c	1	D	neon/Ne		
d	2	D and E – both needed (1) same number of protons but a different number of neutrons / same element but a different number of neutrons (1)			

C2

Higher Tier

Q.1	Mark	Answer	Accept	Neutral answer	Do not accept
a	1	prevent the metals from reacting with air/oxygen/moisture			
b i	1	screen/tongs/small piece of lithium/large volume of water – any one			laboratory coat
ii	1	lithium hydroxide (1) hydrogen (1)	LiOH (1) H ₂ (1)	H	
iii	1	lithium (1)	Li		
iv	2	burns/lilac flame spits (more) melts moves faster fizzes more – any two for 2 marks	disappears quicker	dissolves quicker	

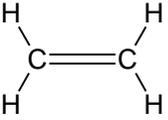
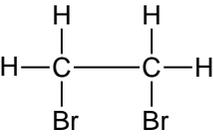
Q.2	Mark	
	6	<p>Indicative content: Description – heating the mixture in the flask to produce hot vapours. In the condenser the water enters at the lower end of the condenser and leaves at the higher point. The hot vapours from the flask then enter the condenser where they then cool, condense and runs down into the beaker as liquid. Explanation – since the boiling point of ethanol is lower than that of water the vapours will initially contain mainly ethanol and will therefore enter the condenser/beaker first.</p> <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>

Q.3	Mark	Answer	Accept	Neutral answer	Do not accept
a	1	sodium	Na		
b	3	Na + Cl ₂ (1) NaCl (1) correct balancing (1)	consequential marking		
c	2	add silver nitrate solution (1) white precipitate/solid formed (1)			

Q.4	Mark	Answer	Accept	Neutral answer	Do not accept
a	1	9			
b	1	6 and 2 – both needed			
c i	1	B	oxide/O ²⁻	oxygen/O	
ii	1	2-	O ²⁻		
d	1	D	neon/Ne		
e	2	D and E – both needed (1) same number of protons but a different number of neutrons / same element but a different number of neutrons (1)			

Q5	Mark	Answer	Accept	Neutral answer	Do not accept
a i	1	ionic			
ii	2	melt/dissolve (in water) (1) allow the ions to move (1)			
b	2	4 electrons between C and both O atoms (1) 8 electrons around both O atoms (1)			
c	3	simple and giant covalent (1) weak bonds between carbon dioxide molecules (1) strong bonds throughout diamond (1)			

Q.6	Mark	Answer	Accept	Neutral answer	Do not accept
a	1	smooth curve by eye starting at 290 and becoming flat at 287.6			
b	1	release/loss of gas			
c	1	prevent the loss of water vapour/moisture			
d	2	curve to the left of graph (1) levelling off at 287.6 (1)			
e	2	2.4 (1) amount of carbon dioxide released depends on the mass of calcium carbonate since the acid is in excess (1)			

Q7	Mark	Answer	Accept	Neutral answer	Do not accept
a	2	bromine becoming colourless/it decolourises (1) addition (1)			
b	2	 (1)  (1)			
c	1	ethane	C_2H_6		

Q.8	Mark	
	6	<p>Indicative content: Hard water does not lather easily with soap whereas soft water does. Calcium or magnesium compounds dissolved in water makes it hard. Hardness in water can be removed by boiling/distillation, adding washing soda and by passing through an ion-exchange column or a detailed account of one method.</p> <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>

Q9	Mark	Answer	Accept	Neutral answer	Do not accept
a	3	mass of oxygen = 0.16 mass of magnesium = 0.48 (1) Mg O $\frac{0.48}{24} \quad \frac{0.16}{16} \quad (1)$ 0.02 0.01 Mg ₂ O (1)			
b	2	some magnesium had not reacted (1) some product lost during the burning (1)	lid not opened enough white smoke given off Mg reacted with nitrogen Mg might have oxidised before expt		
c	3	$M_r(\text{MgO}) = 24 + 16 = 40 \quad (1)$ 2(24) g Mg 2(40)g MgO (1) 48.....80 0.480.8 (1) or 2 mols of Mg gives 2 mols of MgO (1) 0.020.02 Mass of MgO = 0.02 × 40 = 0.8 (1) - correct answer 3 marks			



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