GCSE MARKING SCHEME

SCIENCE - CHEMISTRY

JANUARY 2015

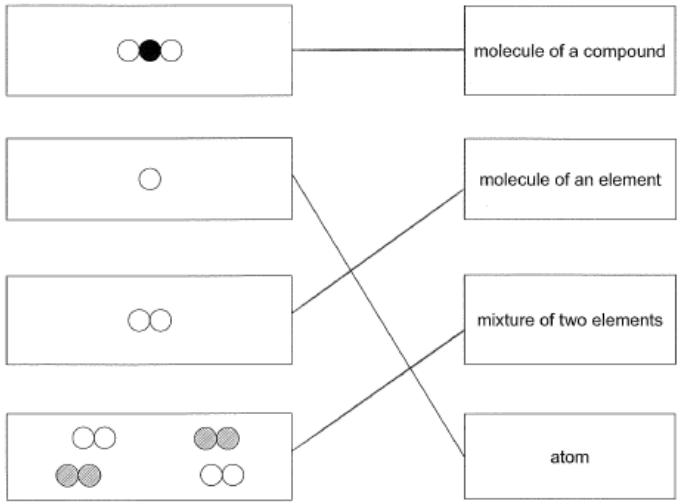
INTRODUCTION

The marking schemes which follow were those used by WJEC for the January 2015 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
Foundation Tier only questions

Question Number								
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
1		*(a)*			2	 all three correct for (2) any one for (1)			
		(b)			2	A electron negative B nucleus positive all four correct for (2) any two for (1)			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
2		*(a)*			3	today's atmosphere has • less water vapour lower • less carbon dioxide lower • no / less sulfur dioxide • more nitrogen • contains oxygen / more oxygen any three for (1) each – comparison required if no credit gained, award (1) for quoting amounts of carbon dioxide **and** nitrogen in volcano and atmosphere	converse	water disappeared amounts quoted	
		(b)			2	photosynthesis (1) respiration (1)	combustion	breathing burning	
		(c)			2	carbon dioxide (1) sulfur dioxide / oxides of nitrogen (1)	formulae	methane	

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
3		*(a)*			4	calcium oxide (1) 2 (1) copper and sulfur (1) Na_2O (1)			
		(b)			2	● hydrogen ○ oxygen ● carbon all three correct for (2) any two for (1)		symbols	

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
4		*(a)*	(i)		1	lemon juice			
			(ii)		1	saliva			
		(b)	(i)		2	magnesium chloride (1) water (1)	formulae		
			(ii)		2	carbon dioxide (1) gas must be correct to award test mark turns limewater milky (1)			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
5		*(a)*	(i)		1	compound that contains hydrogen and carbon only			mixture
			(ii)		2	decaying / remains of / dead (marine) organisms (1) heat / pressure over millions of years (1) must have reference to organisms/correct context to award second mark			
		(b)	(i)		1	bitumen and naphtha	recalled knowledge e.g. wax		
			(ii)		2	22 % (2) award (1) for 156 or 44 ecf possible for incorrect addition (must divide by 2)			
			(iii)	I	1	cracking			
				II	1	polymerisation			

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
6		*(a)*			1	nitrogen	N_2		
		(b)			1	have the same / similar boiling points / both have boiling point of –154°C			
		(c)			2	solid (1) must be correct to award second mark cooled to below 0 °C / below its freezing point / water freezes at 0 °C (1)		water is frozen	
		(d)			1	unreactive / inert		noble non-flammable	

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
7	1	*(a)*			2	liquid (1) must be correct to award second mark melting point below **and** boiling point above room temperature / 20°C (1)			
		(b)			2	less reactive down the group (1) no / very slow reaction (1)	converse		
		(c)			1	$2Fe + 3F_2 \rightarrow 2FeF_3$			
		(d)	(i)		1	$2Cl^- - 2e^- \rightarrow Cl_2$			
			(ii)		1	concentration of iodide in seawater is too low / very low	electricity too expensive		
			(iii)		1	toxic / kills bacteria		gets rid of bacteria	

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
8	2	*(a)*	(i)		2	iron(III) oxide + aluminium → iron + aluminium oxide (1) for **both** reactants (1) for **both** products	correct chemical equation	powder	magnesium as reactant
			(ii)		2	aluminium more reactive than iron (1) must be correct to award second mark takes oxygen from iron / reduces iron(III) oxide (1)			
			(iii)		1	no reaction			
		(b)	(i)		3	iron ore – provides the iron (1) coke – reduces iron oxide / fuel / burns to produce heat / forms carbon monoxide (1) limestone – removes impurities (1)		makes iron source of heat forms slag	
			(ii)	I	1	$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$			
				II	1	loss of oxygen / gain of electrons			

Question Number			
FT	HT	Mark	Answer
9	3	6	**Indicative content**: e.g. **aluminium:** low density – used to build aircraft; good heat conductor – saucepans; good electrical conductor and low density – overhead power cables etc. **copper:** good electrical conductor – electrical wires; good heat conductor – saucepan bases etc. **titanium:** strong with low density – rotors on helicopters, hip replacements etc. credit can be awarded for correct uses and properties of metals not described in the specification **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. **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. **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. **0 marks:** The candidate does not make any attempt or give a relevant answer worthy of credit.

Question Number								
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	4	*(a)*			2	atomic masses (1) reactions / properties of elements (1)		'relative' mass number	
		(b)			2	similarity – groups / periods (1) difference – gaps / two elements in some blocks / some elements in different groups / no noble gases or transition elements in early table (1)	no atomic number in early table / named examples of elements that have changed position	properties columns / rows	
		(c)			2	He 3 2 4 all four correct for (2) any 2 for (1)			

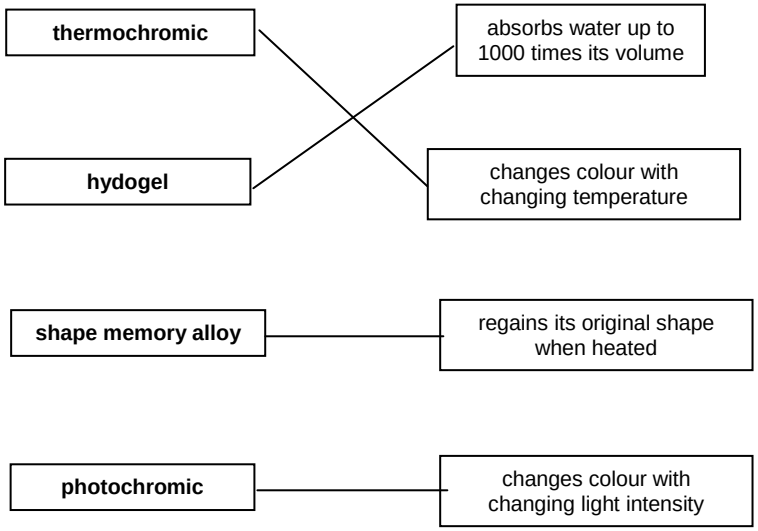
Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	5	*(a)*	(i)		3	copper(II) carbonate (1) copper(II) nitrate (1) sodium hydroxide (1)	formulae		
			(ii)		4	**A** – hydrogen (1) must be correct to award second mark pop with lighted splint (1) **D** – carbon dioxide (1) must be correct to award second mark limewater turns milky (1)	H_2 CO_2	H 'pop test'	
		(b)	(i)		1	Na_2SO_4			
			(ii)		2	heat until half volume / remove some water (1) leave to form crystals (1)	evaporate	 filtration	to dryness
		(c)			1	$Fe_2O_3 + 2H_3PO_4 \rightarrow 2FePO_4 + 3H_2O$			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	6	*(a)*	(i)		2	Cu ions are positively charged (1) must be correct to award second mark opposite charges attract / attracted to negative electrode (1)	Cu^{2+}		
			(ii)		1	$Cu^{2+} + 2e^{-} \rightarrow Cu$			
		(b)	(i)		1	0.20			
			(ii)		1	45% error carried forward (ecf) possible from (i)			
			(iii)		2	0.26 (1) increase of approximately 0.02 g per 1.0 V / last 3 results increase by 0.02 g per 1.0V (1) ecf possible from (i)			

Question Number					Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT	Sub-section							
	7	*(a)*			2	fractions have different length of hydrocarbon / chains / relative mass / M_r (1) must be correct to award second mark which have different boiling points (1)			
		(b)			4	conditions – heat / catalyst (1) explanation • breaks down large / less useful fractions into smaller more useful ones • increases amount of fuels obtained from the crude oil • produces raw materials or monomers for use in making plastics • less waste / more profit any three for (1) each up to max 3	break bonds between C atoms products more useful than reactants		

Question Number			
FT	HT	Mark	Answer
	8	6	**Indicative content**: reasons for: strengthens tooth enamel and prevents tooth decay reasons against: causes fluorosis in large concentrations graph shows no further benefit above a concentration of 0.9 but increasing occurrence of fluorosis after 0.7 conclusion: should add from 0.4-0.7 as reduces DMFT but no increase in fluorosis **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. **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. **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. **0 marks:** The candidate does not make any attempt or give a relevant answer worthy of credit.

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
1		*(a)*	(i)		1	lakes / rivers / streams / aquifers / groundwater		surface water / rain / wells / springs	seawater sewers
			(ii)		1	1	sedimentation		
			(iii)		1	chlorination			
		(b)			1	stop washing cars/ windows stop watering gardens/ using a hose pipe don't run water when washing teeth/ low flush toilets/ dual flush toilets/ only run washing machine once a week/ only run washing machine with a full load/ shower instead of bath use waste water to flush toilets / clean car		don't wash don't use water collect rainwater use bottled water	

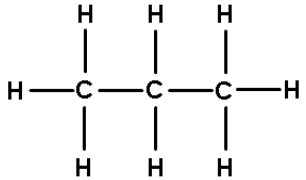
Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
2					3	 all correct for 3 marks any two correct for 2 marks, any 1 correct for 1			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
3		*(a)*	(i)		2	A and B both needed (1) little / poor / no lather (1) second mark alone may be awarded if only A *or* B given			
			(ii)		2	A is temporary hard water and B is permanent (1) any of following for (1) • temporary is softened by boiling • permanent is not softened by boiling • temporary forms lather after boiling • permanent doesn't form lather after boiling		ignore reference to sample C unless incorrect	

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
		(b)	(i)		3	• salt remains in flask / salt left behind • water boils / water turns to steam / steam enters condenser • steam condenses / steam turns back to water in condenser / steam cools to form water • distillation / desalination any 3 for (1) each maximum (1) for description of separation of ethanol and water			
			(ii)		2	a lot of lather / froth / bubbles / foam (1) (pure water) contains no dissolved solids / (pure water) contains no Ca^{2+} / (pure water) contains no Mg^{2+} (1)	accept diagram reference to calcium / magnesium		

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
4		*(a)*			1	purple and yellow both needed			
		(b)			2	0.4 × 10 (1) 4 (1) award (2) for correct answer only (cao) no error carried forward (ecf)			
		(c)			1	(food colourings are) soluble (in water) / (food colouring) dissolve (in water)			

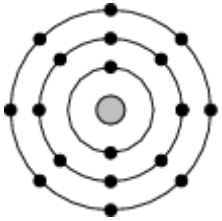
Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
5		*(a)*			1	value in the range 19–20			
		(b)			1	line right of original graph from (0,90) to (35,30) – tolerance of 1 small square			
		(c)			2	precipitate formed/insoluble substance formed (1) light cannot travel through/ stops light / blocks light (1)	goes cloudy/ milky		
		(d)			1	any of following (apparatus) not light tight / light can get in around tube precipitate formed not dense enough / thick enough / precipitate formed does not block all the light		light all around / light present	

Question Number					Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT	Sub-section							
6		*(a)*			1	C_3H_6		CH_2CHCH_3	
		(b)			1				
		(c)			3	• double bond opens (1) R • ethene molecules join together • long chain / single chain formed / polymer formed • addition reaction/ addition polymerisation any two for (1) each		becomes single bond loses double bond 'additional'	

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
7		*(a)*	(i)		1	sodium atom 1 chlorine atom 7 both needed			
			(ii)	I	2	sodium (atom) loses one electron (1) chlorine (atom) gains one electron (1) award (2) for electron transferred from sodium to chlorine maximum (1) if transfer of more than 1 electron implied			
				II	1	sodium chloride / NaCl			
		(b)			2	23 + 35.5 + 3(16) (1) 106.5 (1) award (2) for cao no ecf			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
8	1	*(a)*			3	two possible approaches either • below 54°C, NaCl more soluble (1) • at 54°C, solubilities the same (1) • above 54°C, $CuSO_4$ more soluble (1) or • below 54°C, $CuSO_4$ increases a lot with temperature, NaCl does not (1) • above 54°C, trend continues but $CuSO_4$ is more soluble than NaCl (1) • at 54°C, solubilities the same (1)	converse converse		
		(b)			2	56 – 29 = 27 (1) no tolerance 27/2 = 13.5 (1) ecf possible award (2) for cao			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
		(c)			2	water freezes at 0°C / is ice at 0°C / is solid at 0°C / 0°C is the freezing point of water (1) water boils at 100°C / is steam at 100°C / is a gas at 100°C / 100°C is the boiling point of water (1)	these are the freezing point and boiling point of water (2) these are the fixed points of water (2) water is only liquid between these two temperatures (2) water is liquid between these temperatures (1)	melting point	

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
9	2	*(a)*	(i)		5	symbol protons neutrons electrons fluorine 10 9 calcium $^{40}_{20}Ca$ 20 argon 18 (1) for each correct answer			
			(ii)		1	calcium/Ca and argon /Ar both needed			
			(iii)		1			2,8,8	
		(b)			2	Similarity: (same) number of protons (1) Difference: (different) number of neutrons (1)	p for proton n for neutron	reference to atomic number and mass number	reference to electrons

Question Number				
FT	HT		Mark	Answer
9	3	*(a)*	6 QWC	Indicative content • all three metals float, move about the water surface and produce bubbles • lithium reacts slowly without melting • sodium reacts quickly forming a sphere • potassium reacts violently forming a sphere and burning with a lilac flame • reactivity increases down the group *word /symbol equations not expected but creditworthy* 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. 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. 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. 0 marks The candidate does not make any attempt or give a relevant answer worthy of credit.
		(b)	2	Na_2O (1) correctly balanced (1) formula must be correct before balancing mark can be awarded

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	4	*(a)*			5	step 1 – use of soap solution to identify distilled water, needs fair testing element for both marks • add 1cm^3 soap (solution) to 5 cm^3 of each water sample (1) • shake for 1 minute/shake for the same time (1) • distilled water most froth (1) step 2 • boil unidentified samples and repeat step 1 (1) • temporary hard water lathers after boiling; permanent hard water still does not lather after boiling (1) credit alternative methods – up to (3) for method/fair test and up to (2) for conclusions	add soap to each water sample and shake (1)		washing up liquid
		(b)			1	reference to appliance needed furs up kettles/ kettles less efficient / boilers fur up / boilers less efficient / pipes fur up / pipes less efficient		reference to soap 'wastes energy' 'decreases efficiency' 'blocks pipes'	

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	5	*(a)*			3	two discrete diagrams needed - diagram 1 showing transfer of electrons - diagram 2 showing ions diagram 1 two potassium atoms lose 1 electron each (1) one sulfur atom gains 2 electrons (1) diagram 2 two K^+ ions and one S^{2-} ion formed (1) *octet of electrons around* S^{2-} *not needed*	if transferred electrons on both potassium and sulfur award (1)		
		(b)			2	two shared pairs of electrons (S—F) (1) octet of electrons around S and both F atoms (1)			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	6	*(a)*			1	A steepest line / steepest graph / finishes in the shortest time both needed	greatest gradient / highest gradient / quickest reaction	precipitate	
		(b)			2	time = 22 (1) 0.045 / 0.0455 / 0.04545 (1) award (2) for cao	21 0.048 / 0.0476		0.05
		(c)			3	higher the temperature, faster the rate (1) particles have more energy / move faster at higher temperature (1) must be correct to award third mark therefore greater chance of (successful) collisions / more (successful) collisions per second (1)	more particles have required activation energy	more collisions	

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	7	*(a)*			3	A iron(III) chloride / $FeCl_3$ (1) B sodium chloride / NaCl (1) C bromine / Br_2 (1)		iron chloride gas	iron(II) chloride Br
		(b)	(i)		2	$Ag^+ + Cl^-$ (1) AgCl (1) ignore state symbols			
			(ii)		3	$2AgNO_3 + MgBr_2 \rightarrow 2AgBr + Mg(NO_3)_2$ award (1) each for both products balancing (1) only award balancing mark if both products are correct			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	8	*(a)*			3	mass carbon and hydrogen divided by respective A_r values e.g. carbon 9/12 and hydrogen 2/1 (1) ratio of 3:8 (1) C_3H_8 (1) ecf possible if formula given is an alkane award (1) mark only for correct answer with no working			
		(b)			2	$M_r(C_4H_{10})$ = 58 (1) (48/58) × 100 = 82.76 (1) consequential marking	82.8 / 83		

Question Number			
FT	HT	Mark	Answer
	9	6 QWC	Indicative content • ethene (monomer) contains a C=C bond/ ethene (monomer) is unsaturated • double bonds in ethene molecules 'open' • ethene molecules join together • long chain molecule formed/ polymer formed/ single molecule formed • balanced symbol equation, showing repeating unit • monomer & repeating unit, for example, for polypropene from propene/ PVC from chloroethene / polytetrafluoroethene from tetrafluoroethene 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. 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. 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. 0 marks: The candidate does not make any attempt or give a relevant answer worthy of credit.

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