GCSE MARKING SCHEME

SUMMER 2016

SCIENCE - CHEMISTRY C2
4472/01/02

INTRODUCTION

This marking scheme was used by WJEC for the 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.

GCSE Science - Chemistry 2

Summer 2016

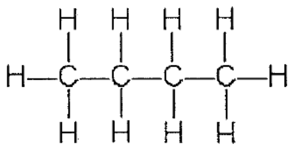
Mark Scheme

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
1		*(a)*			2	lithium and oxygen → lithium oxide sodium and chlorine → sodium chloride iron and fluorine → iron fluoride lithium and water → lithium hydroxide and hydrogen all 4 for (2) any 2/3 (1)			
		(b)			2	lithium red (1) sodium yellow (1)	 orange		
		(c)			2	30 (2) if incorrect allow (1) for recognising the presence of two Li atoms and one O atom			

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
2		*(a)*			1	bubbles / powder disappears			
		(b)			1	conical flask			
		(c)	(i)		1	**A** – has steepest curve / finishes first / gives same volume of gas in least time	fastest reaction / highest rate		
			(ii)		2	surface area (of solid) (1) concentration (of acid) (1)	size of particles catalyst	stirring strength of acid	
		(d)	(i)		2	gas produced **escapes** from flask (1) mass decreases (1)		calcium carbonate gets smaller	
			(ii)		1	continuous or more regular readings / automatically recorded / graph can be produced by computer / stores results		more accurate / precise / reliable / fair / no human error	

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
3		*(a)*			1	**Y**			
		(b)			2	solubilities of both increase (with temperature) / both same at 82 °C (1) **X** has large increase and **Z** has small increase / **X** less soluble than **Z** below 82 °C / **X** more soluble than **Z** above 82 °C (1)		both straight lines	
		(c)	(i)		3	all points correct (2) [(1) for minimum four correct] curve through points (1)			
			(ii)		1	20	value based on incorrectly drawn graph		

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
4		*(a)*			2	removes (small) insoluble particles (2) removes (small) particles (1)		dirt / mud / bits / solids / molecules	sticks / stones
		(b)			2	chlorine is added / chlorination (1) kills bacteria / germs (1)	removes bacteria	add disinfectant	
		(c)			1	to conserve / save water (during drought conditions)		doesn't rain much to prevent waste	
		(d)			2	boil (1) condense vapour (to give pure water for drinking) (1)	evaporate		

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
5		*(a)*			1	ethane and ethene (both needed)		C_2H_6 and C_2H_4	
		(b)			2	both are hydrocarbons / both contain carbon and hydrogen (atoms only) (1) double bond (between carbon atoms) in alkenes / alkenes are unsaturated (1)	alkanes have single bonds **only**	covalent bonding	
		(c)			1		methylpropane structure		

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
6		*(a)*			1	strong bonds (between carbon atoms)		many bonds	
		(b)			1	graphite - due to **electrons moving** freely (between layers)	electrons delocalised		
		(c)			2	layers held weakly (1) layers can move over each other (to leave mark on paper) (1)	 layers can rub off		

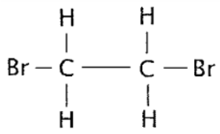
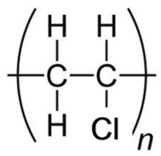
Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
7	1	*(a)*			2	**D** and **E** (1) both contain 2 shells (occupied by electrons) (1)			
		(b)			1	**B** because it has a total of 15 **electrons**	2,8,5	15 protons	
		(c)			3	any three for (1) each • contains 13 protons • contains 13 electrons • contains 14 neutrons • electronic configuration is 2,8,3 / has 3 electron shells / has 3 outer shell electrons		atomic number mass number	

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
8	2	*(a)*			2	NaBr (1) correctly balanced (1) $2Na + Br_2 \rightarrow 2NaBr$	Na^+Br^-		
		(b)			3	prepare a solution of both solids (1) (add silver nitrate solution to both –) sodium chloride would give a white **precipitate** (1) sodium iodide would give a yellow **precipitate** (1)	award (1) for both colours if no mention of precipitate		
		(c)	(i)		1	correctly balanced $2Al + 3Cl_2 \rightarrow 2AlCl_3$			
			(ii)		3	$M_r(AlCl_3) = 133.5$ or $A_r(Cl) \times 3 = 106.5$ (1) $\frac{106.5}{133.5} \times 100$ 79.8% - accept any value from 79.7 - 79.8 (1)	80%		79%
		(d)	(i)		1	75%			
			(ii)		2	any two for (1) each • reactants are impure • process incomplete • loss of products			incorrect measurements

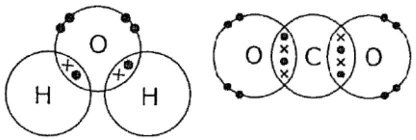
Question Number							
FT	HT	Sub-section			Mark	Answer	
9	3				6	**Indicative content:** Properties – both change **colour** reversibly according to change in conditions photochromic changes in response to **light** whereas thermochromic changes in response to **heat** Uses – photochromic – sunglasses lenses / windows thermochromic – thermometers / childrens feeding bowls / mugs etc **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								
	4	*(a)*			2	more oxygen dissolves at lower temperature (1) more dissolved oxygen will sustain / support more fish (1)			
		(b)			2	9 (mg per dm^3) – read from graph (1) 0.9 g (1) award (2) for correct answer only			
		(c)			2	0.014 g oxygen in 1 dm^3 (1) $\frac{3.3}{0.014} = 235$ (1) accept any sensible value based on calculation			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	5	*(a)*			4	the higher the concentration the faster the reaction / higher the rate (1) more particles in **given volume** when concentration is higher (1) more successful collisions **per second** / more chance of successful collisions (1) same argument using 'double' the rate and 'twice' the number of particles etc. (1)		stronger than acid	
		(b)	(i)		1	mass being lost is very small / would not register on a one decimal place balance		more accurate	
			(ii)		3	both M_r values H_2 = 2 and CO_2 = 44 (1) CO_2 is a heavier gas (1) loss in mass would be greater / smaller (percentage) error in measurements (1)	more accurate results		

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	6	*(a)*	(i)		2	bromine is decolourised / (orange) solution turns colourless (1) addition reaction has taken place (1)	 double bond present / broken alkenes are unsaturated	clear	
			(ii)		1			$C_2H_4Br_2$	
		(b)	(i)		1				
			(ii)		3	when heated thermoplastics melt / soften / can be reshaped (1) no bonds between chains / weak forces between chains (1) chains are able to slide over one another (1)	 no crosslinks		 'layers' in place of chains

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
	7	*(a)*	(i)		3	become more reactive up group or converse (1) any 2 for (1) each • chlorine will displace both bromine (from bromide) and iodine (from iodide) therefore most reactive • iodine doesn't displace either of the others so least reactive • bromide displaces iodine (from iodide) but not chlorine (from chloride) therefore more reactive than iodine but less reactive then chlorine	Cl > Br > I		
			(ii)		3	reactant formulae Cl_2 + KI (1) product formulae I_2 + KCl (1) balancing $Cl_2 + 2KI \rightarrow I_2 + 2KCl$ (1) all formulae must be correct to award balancing mark	ionic equation		
		(b)			3	M_r(AgBr) = 188 and M_r($AgNO_3$) = 170 (1) $\frac{47}{188}$ = 0.25 (1) 0.25 × 170 = 42.5 (1) award (3) for correct answer only accept alternative method ecf possible here			

Question Number						
FT	HT	Sub-section			Mark	Answer
	8				6	**Indicative content:** Description of covalent bonds as sharing pairs of electrons with one electron coming from each atom involved in the bonding allowing all atoms to get full outer electron shells Dot and cross diagrams showing bonding present in both water and carbon dioxide  Comparison of single bond as being one shared pair and covalent as two shared pairs. Reference to need for double bonds in carbon dioxide in order to fill outer electron shells **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.