



GCSE MARKING SCHEME

SUMMER 2016

**SCIENCE - CHEMISTRY C3
4493/01/02**

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 3

Summer 2016

Mark Scheme

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
1		(a)	(i)		1	$2\text{CO}_2 + 3\text{H}_2\text{O}$			
			(ii)		1	air / atmosphere			
		(b)			1	any of following <ul style="list-style-type: none"> solvent alcoholic drinks / beer / named alcoholic drink antibacterial wipes / mouthwash 	drinks		
		(c)			3	wet cloth / safety mat over the top / fire blanket (1) remove air / oxygen (1) any reference to breaking fire triangle (1)		fire extinguisher / paper	

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
2	HT	(a)		3	$ \begin{array}{ccccc} & \text{H} & \text{H} & \text{H} & \\ & & & & \\ \text{H} & - \text{C} & - \text{C} & - \text{C} & - \text{H} \\ & & & & \\ & \text{H} & \text{H} & \text{H} & \end{array} $ (1)			
					$\text{C}_3\text{H}_7\text{OH} / \text{C}_3\text{H}_8\text{O}$ (1)			
					$ \begin{array}{ccc} & \text{H} & \text{H} \\ & \diagdown & / \\ & \text{C} = \text{C} & \\ & / & \diagdown \\ \text{H} & & \text{H} \end{array} $ (1)			
		(b)		1	ethene and propene – both needed	C_2H_4 and C_3H_6		

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT							
3		(a)	(i)	2	15 (2) if answer incorrect award (1) for one correct step i.e. addition of values in pie chart to get 85 or subtraction of incorrect total from 100			
			(ii)	2	66 000 tonnes (2) if answer incorrect award (1) for identification of 33%			
		(b)	(i)	1	any of following <ul style="list-style-type: none"> • bubbles / fizz / effervescence • metal disappears • temperature increases 		exothermic	
			(ii)	2	reacts more quickly with sulfuric acid – bubbles more quickly, metal disappears more quickly, temperature rises more quickly (greater temperature rise) (1) sulfuric acid stronger (1)	converse answer for ethanoic acid	stronger reaction	

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT							
4		(a)	(i)	1	carbon oxygen nitrogen hydrogen all needed, any order		C O N H	
			(ii)	1	ammonium nitrate			ammonia nitrate
		(b)		1	any of following <ul style="list-style-type: none"> lasts longer in the soil fertiliser does not need to be spread as often less washed away by rain 		saves money less waste reference to eutrophication	
		(c)		3	gets into water supply (1) causes overgrowth of plants in water / clogs up waterways (1) additional (1) for development of either point e.g. blue baby syndrome caused by nitrogen compounds in water supply, decrease in oxygen content / dead fish resulting from overgrowth of plants			
		(d)		1	neutralise soil acidity / reduce acidity	raise pH	reacts with acids	

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
5		(a)		1	any of following <ul style="list-style-type: none"> • solid formed in solution • solid formed when two solutions react • insoluble substance formed in solution • insoluble substance formed when two solutions react 		solid formed	
		(b)		1	carbon dioxide	CO ₂		
		(c)	(i)	2	sodium compound will give yellow flame (1) potassium compound will give lilac flame (1)	yellow-orange		
			(ii)	2	add silver nitrate solution (1) bromide gives cream precipitate and iodide gives yellow precipitate - both needed (1)			
			(iii)	1	silver nitrate + potassium bromide silver bromide + potassium nitrate reactants and products needed	correct symbol equation		

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
6		(a)		1	quicklime		CaO	
		(b)	(i)	2	solid expands / crumbles (1) visible vapour given off / hissing sound (1)	breaks up heat given off steam given off	exothermic	
			(ii)	2	CaO + H ₂ O (1) Ca(OH) ₂ (1)		word equation	

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
7	1	(a)		2	all points plotted correctly – tolerance $\pm 1/2$ square (1) (ignore missing 0,0) smooth curve (1)			
		(b)		1	300°C and 500 atm – both needed			
		(c)		2	the higher the pressure, the higher the yield / the lower the pressure, the lower the yield (1) the higher the temperature, the lower the yield / the lower the temperature, the higher the yield (1)			
		(d)	(i)	2	NH ₃ (1) balancing mark may only be awarded if above formula is correct 3H ₂ and 2NH ₃ (1)			
			(ii)	1	either of following <ul style="list-style-type: none"> reversible reaction reaction that can go both ways 			

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
8	2	(a)		1	any of following <ul style="list-style-type: none"> to identify the end-point to find the exact volume of acid required to neutralise the alkali to find the exact volume of acid required to use up all the alkali 			
		(b)		1	alkali is more concentrated because more than 25.0 cm ³ of acid are needed to neutralise it			HCl is dilute
		(c)	(i)	1	29.5 cm ³			
			(ii)	4	add 29.5 cm ³ [or mean value from (i)] of hydrochloric acid to 25.0 cm ³ of sodium hydroxide (1) no indicator (1) evaporate (1) additional (1) for a practical aspect e.g. measure solutions using pipette/burette or leave on window sill max (2) to be awarded if indicator added			

Question Number		Sub-section		Mark	Answer
FT	HT				
9	3	(a)		6	<p>Indicative content</p> <p>Tests given for all three gases – clearly identified</p> <ul style="list-style-type: none"> • carbon dioxide – turns limewater milky • hydrogen – squeaky pop when ignited • oxygen – re-lights a glowing splint <p>Plan using two test only e.g.</p> <ul style="list-style-type: none"> • shake gases A, B and C with limewater, carbon dioxide will make it turn milky • test two remaining gases with a glowing splint, oxygen will re-light it • the remaining gas is hydrogen <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	(b)	(i)						
9	3		(i)		1	ammonia	NH ₃		ammonium ammonium hydroxide
			(ii)		2	damp red litmus paper / universal indicator paper (1) turns blue (1)			

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT							
	4	(a)		2	similarity – either of following for (1) <ul style="list-style-type: none"> • both give off carbon dioxide • both form oxides difference – either of following for (1) <ul style="list-style-type: none"> • calcium carbonate stays white but copper(II) carbonate changes colour / turns from green to black • calcium carbonate has a much higher decomposition temperature 			
		(b)		2	CaCO ₃ (1) CaO + CO ₂ (1)			
		(c)		2	no carbon dioxide given off / no reaction (1) either of following for (1) <ul style="list-style-type: none"> • sodium carbonate more stable than calcium carbonate and copper(II) carbonate • requires more energy to break bonds • sodium is more reactive than calcium and copper 			

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT							
	5	(a)		1	A and F – both needed			
		(b)		2	D (1) any of following for (1) <ul style="list-style-type: none"> • one carbon atom has only three bonds • one carbon atom has five bonds • carbon atoms must always have four bonds 		not enough hydrogens in the formula	
		(c)		1	<pre> H H-C-H H H H-C-C-C-H H H H-C-H H </pre>			
		(d)		3	bubble through bromine water (1) C – no change (1) E – orange/brown solution turns colourless (1)			
		(e)		3	ethanol (1) O—H at around 3300 (1) C—O at around 1100 (1)			

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT	(a)	(i)	2	pale green (1) precipitate forms (1)			
	6		(ii)	3	$\text{Fe}^{2+} + 2\text{OH}^- \rightarrow \text{Fe}(\text{OH})_2$ (3) if incorrect award (1) for correct reactants and/or (1) for correct product			
		(b)		2	add barium chloride solution (1) white precipitate forms (1)			

Question Number		Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT							
	7	(a)		2	0.0025 mol (2) if answer incorrect award (1) for 25.0×0.1			
		(b)		1	0.005 mol error carried forward (ecf) from part (a)			
		(c)		2	0.233 / 0.23 mol/dm ³ (2) if answer incorrect award (1) for 0.005 / 21.5 ecf from part (a)			
		(d)		2	10.75 cm ³ (1) this reaction involves a 1:1 ratio rather than 2:1 therefore half the volume of alkali is needed (1)			

Question Number		Mark	Answer
FT	HT		
	8	6	<p>Indicative content Burn sulfur in air to give sulfur dioxide; $S + O_2 \rightarrow SO_2$ Convert sulfur dioxide into sulfur trioxide; $450\text{ }^\circ\text{C}$, vanadium(V) oxide catalyst; $2SO_2 + O_2 \rightarrow 2SO_3$ Problems linked with converting SO_3 to the acid Dissolve sulfur trioxide in concentrated sulfuric acid forming oleum; add water</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>