GCSE MARKING SCHEME

CHEMISTRY (LEGACY)

JANUARY 2013

INTRODUCTION

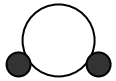
The marking schemes which follow were those used by WJEC for the January 2013 examination in GCSE CHEMISTRY (LEGACY). They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken 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.

GCSE CHEMISTRY (LEGACY)

C1 Mark Scheme - January 2013

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
1		(a)			1				
		(b)			2	CO_2 (1) carbon dioxide (1)	O_2C		

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
2		(a)			2	A – combustion B – respiration C – photosynthesis all three correct for (2) one correct for (1)			
		(b)			1	increase			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
3		(a)	(i)		1	naphtha			
			(ii)		1	heated / boiled	vaporised evaporated		
			(iii)		1	condensation	condensed		
		(b)	(i)		1	21			
			(ii)		1	diesel oil			

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
4		(a)	(i)		1	length of a protein molecule 40nm			
			(ii)		1	million			
		(b)			1	kills germs			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
5		(a)			1	sulphur	S		
		(b)			1	melting point is high boiling point is high density is high any one for (1)		numerical values e.g. mp = 1540	highest mp
		(c)			2	chlorine (1) boiling point < room temperature / 20 °C (1)	Cl_2	Cl	
		(d)			1	poor conductor / brittle / dull			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
6		(a)	(i)		1	21.5 ± 0.1			
			(ii)		1	2.5			
		(b)			2	sodium hydroxide + hydrochloric acid (1) sodium chloride + water (1)	NaOH + HCl $NaCl + H_2O$		
		(c)			1	exothermic – temperature increases both needed for (1)	heat given out		

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
7		(a)			3	all points plotted correctly (2) any six points plotted correctly (1) suitable curve of best fit (1)	 consequential curve		
		(b)			1	37 ± 0.5			
		(c)			2	24 (1) volume of gas depends on the amount of calcium carbonate / since half the amount of calcium carbonate was used, half the volume of gas was produced (1)			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
8	1	(a)	(i)		1	water		H_2O	
			(ii)		1	hydrogen and chlorine both needed for (1)		H and Cl	
			(iii)		1	sulphuric acid		H_2SO_4	
		(b)	(i)		1	NH_4Cl	$NH_4^+Cl^-$		
			(ii)		1	Na_2O	$Na^+_2O^{2-}$ / $(Na^{+)}_2O^{2-}$		

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
9	1	(a)			2	C and D - both needed (1) both have the same number of (occupied) shells / both have three (occupied) electron shells (1)	aluminium and argon / Al and Ar		
		(b)			2	E (1) two electrons in the outer shell (1) (accept when A given above)	calcium		A / He
		(c)	(i)		1	D			
			(ii)		1	light bulbs / welding			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
10	2	(a)			1	sulphuric	H_2SO_4		
		(b)			1	hydrogen	H_2		H
		(c)			1	carbon dioxide	CO_2		
		(d)			1	sodium sulphate	Na_2SO_4		
		(e)			1	copper oxide	CuO		
		(f)			1	copper sulphate	$CuSO_4$		

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
11	3				3	• gap formed • magma rises or pushes (through the mantle) • magma cools or solidifies / forms new rock / forms igneous rock / forms a crust • forms (oceanic) ridges or volcanoes any three for (1) each	lava	earthquakes	

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	4	(a)	(i)		1	Cs			
			(ii)		1	rubidium / Rb			
			(iii)		1	potassium / K			
		(b)			1	2,8,1			
		(c)	(i)		1	to prevent the metal reacting with air / moisture / water vapour			
			(ii)	I	1	lithium / sodium	Li / Na		
				II	1	H_2			
			(iii)		1	goggles / safety screen / small piece of metal / tweezers / gloves / large volume of water			
		(d)	(i)		1	lilac	purple / pink		
			(ii)		3	$K + O_2$ (1) K_2O (1) $4 + 1 \rightarrow 2$ balancing (1)			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	5	(a)	(i)		2	amount of carbon dioxide decreases (1) amount of oxygen increases (1)	plants take in carbon dioxide (1) and release oxygen (1)		
			(ii)		2	amount of carbon dioxide increases (1) amount of oxygen decreases (1)	humans breathe in oxygen (1) and breathe out carbon dioxide (1)		
		(b)			1	(carbon dioxide removed) by plants / photosynthesis / dissolved in oceans / absorbed by rocks			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	6	(a)			1	1000000 / million			
		(b)			1	toxic to bacteria / antibacterial / antiviral / antifungal	sterilising		
		(c)			2	long term effects not known (1) may cause cancer / may be hazardous to health (1)		may cause harm	 will cause cancer

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	7	(a)			2	curve from the origin to 120 cm^3 (1) curve drawn to the left of curve A (1)			
		(b)	(i)		2	curve from the origin to 60 cm^3 (1) curve drawn to the left of curve A (1)			
			(ii)		2	bigger surface area greater chance of collision faster reaction any two for (1) each			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	8	(a)	(i)		1	fractional distillation			
			(ii)		3	• crude oil heated / enters as vapour • column is hot at the bottom / cool at the top • larger molecules / higher bp molecules liquid at the bottom • different fractions condense at different levels any three for (1) each			
		(b)			4	energy needed to break reactant bonds $= 4(413) + 2x / 1652 + 2x$ (1) energy released in the formation of products $= 2(805) + 4(464) / 1610 + 1856 / 3466$ (1) $1652 + 2x - 3466 = -818$ (1) $2x = 3466 - 818 - 1652 = 996$ $x = \frac{996}{2} = 498$ (1) correct answer only (4)			

GCSE CHEMISTRY (LEGACY)

C2 Mark Scheme - January 2013

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
1		(a)	(i)		1	**A**			
			(ii)		1	artificial snow			
		(b)			1	forehead thermometers			
		(c)	(i)		1	carbon	C		
			(ii)		1	they are fixed in place			
			(iii)		1	similar structure to asbestos / can be inhaled / may cause lung problems		dangerous	

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
2		(a)	(i)		1	low density / good conductor **of electricity**		good conductor	
			(ii)		1	good conductor **of heat**		good conductor	
		(b)			1	hard / strong / low density			
		(c)			1	joint replacements / pins / plates	named joint		

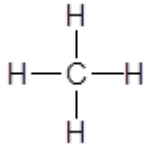
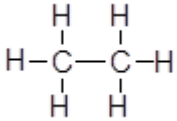
Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
3		(a)			1	ammonium sulphate	$(NH_4)_2SO_4$		
		(b)			1	nitric (acid)	HNO_3		
		(c)			1	neutralisation	exothermic		
		(d)	(i)		2	**C** (1) doesn't contain nitrogen / N (1)			
			(ii)		2	**B** (1) contains nitrogen **and** sulphur / N **and** S (1)			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
4		(a)			2	calcium (1) magnesium (1)	Ca Mg		
		(b)			5	**Method** : add soap solution to water sample (1), shake (1), measure height of froth / scum (1) **Fair test** : same volume of water / same amount of soap solution / shake for same amount of time or same number of times any two for (1) each	alternative suitable methods e.g add soap slowly from burette (1) shake (1) and record volume needed to form permanent lather (1)	same temperature	

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
5		(a)	(i)		1	magnesium zinc copper must be in correct order	Mg Zn Cu		
			(ii)		2	magnesium sulphate (1) zinc (1)	$MgSO_4$ Zn		
		(b)	(i)		1	carbon is able to reduce the iron oxide both needed	removes O from the iron oxide	displaces	
			(ii)	I	1	aluminium is more reactive than carbon	aluminium is too reactive	aluminium is reactive	
				II	1	electrolysis			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
6		(a)			4	diagrams are in the following order graphite diamond sodium chloride copper ice all correct for (4) three correct for (3) two correct for (2) one correct for (1)			
		(b)			1	copper and graphite both needed			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
7	1	(a)			5	20 20 $^{27}_{13}Al$ potassium 20			
		(b)			1	individual atoms are too small / light			
		(c)			2	1 + 14 + (16 × 3) (1) 63 (1) correct answer only (2)			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
8	2	(a)			2	 (1)  (1)			
		(b)			2	heat (1) catalyst (1)	high temperature / any temp >400 °C		
		(c)	(i)		1	polymerisation		addition	
			(ii)		1	packaging / household containers / electrical insulation / moisture barriers in construction industry			
			(iii)		1	don't decompose / less need for landfill sites / litter can pose problems to wildlife			

Question Number		Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT								
	3	(a)	(i)		1	hydrogel	polymer gel		
			(ii)		1	(strong cross links create an) open structure			
			(iii)		1	artificial muscles / robot actuators / absorbers of toxic chemicals / water retainers for plants / artificial snow	in compost	compost	
		(b)			1	regain shape (after being bent) / supereleastic / more difficult to break			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	4	(a)			1	electrical	electricity	heat	
		(b)	(i)		1	Al^{3+} and O^{2-} both needed			
			(ii)		1	opposite charges attract (each other)		Al is positive and cathode is negative	
		(c)			1	ions must be free to move			
		(d)			2	aluminium oxide (1) aluminium + oxygen (1)	 correct formulae		

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	5	(a)			1	50			
		(b)			1	38 ± 1			
		(c)			1	156			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	6	(a)			3	K atom loses 1 electron (1) Cl atom gains 1 electron (1) K^+ and Cl^- ions form (1) diagrams must show situation before and after bonding clearly - NO ambiguity e.g. electron on atom/ion at the same time or charges associated with atoms			
		(b)			2	pair of electrons shared between two chlorine atoms (1) full octet around both chlorine atoms (1)			
		(c)			2	layers are able to slide over each other (1) weak forces between layers (1)			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	7	(a)			2	H_2 (1) balancing 3 and 2 (1)			
		(b)	(i)		1	70 %			
			(ii)	I	1	faster reaction at 450 °C / too slow at 350 °C			
				II	1	equipment needed for high pressure expensive / too dangerous at high pressure		expensive	
		(c)	(i)		3	$M_r(NH_3) = 17$ **and** $M_r(NO) = 30$ (1) 255/17 = 15 (1) 15 × 30 = 450 (1) correct answer only (3)			
			(ii)		2	theoretical mass of product = 120 **and** total mass of reactants = 228 (1) 120 / 228 × 100 = 52.6 % (1) cao (2)			

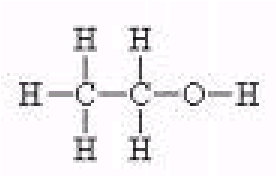
Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	8	(a)			1	loss of oxygen			
		(b)	(i)		1	0.4 g			
			(ii)		3	mass / A_r 3.2 / 64 = 0.05 0.4 /16 = 0.025 either for (1) correct ratio = 2:1 (1) formula = Cu_2O (1)			

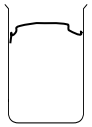
GCSE CHEMISTRY (LEGACY)

C3 Mark Scheme - January 2013

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
1		(a)	(i)		1	12			
			(ii)		1	building roads			
		(b)			3	creates more wealth for the community (1) more jobs locally (1) provides materials for the building industry (1) any order			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
2		(a)			3	A filtration B chromatography C evaporation			
		(b)	(i)		1	B	chromatography		
			(ii)		1	A	filtration / filter		

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
3		(a)	(i)		1	propane			
			(ii)		1				
			(iii)		1	C_3H_6			
		(b)	(i)		1	propane			
			(ii)		1	ethanol			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
4		(a)	(i)		1	air			oxygen
			(ii)		2	sulphur dioxide + oxygen (1) sulphur trioxide (1)	$SO_2 + O_2$ SO_3		
			(iii)		1	catalyst			
		(b)	(i)		1	volume of 'material' in beaker increased e.g. 			
			(ii)		1	hydrogen and oxygen both needed	'H' and 'O'		H_2 and O_2
		(c)	(i)		1	B			
			(ii)		1	(wear) goggles / gloves / laboratory coat (carry out procedure in a) fume cupboard	visor / protective clothing		

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
5		(a)	(i)		2	blue precipitate (1) white precipitate (1)			
			(ii)		2	yellow flame (1) bubbles formed (1)	fizzing	gas formed / carbon dioxide	
		(b)			2	ammonia turns damp red litmus paper blue (1) oxygen relights glowing splint (1)			

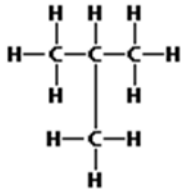
Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
6		(a)	(i)		1	18			
			(ii)		1	30			
			(iii)		1	25 ±1			
		(b)	(i)		2	sodium sulphate (1) water and carbon dioxide (1)			
			(ii)		1	Na_2SO_4			

Question Number									
FT	HT	Sub-section			Mark	Answer		Accept	Neutral answer	Do not accept
7	1				4	Method 1: water (1) cools / removes heat (1) Method 2: bulldoze down trees / remove trees (1) removes fuel (1)		fire breaks		

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
8	2	(a)	(i)	I	1	heat	roast / high temperature	warm / raise temperature	
				II	1	(thermal) decomposition			
			(ii)		1	carbon dioxide	CO_2		
			(iii)		1	water	H_2O		
		(b)			3	$Ca(OH)_2$ + HCl (1) $CaCl_2$ + H_2O (1) balancing: 1:2(HCl):1:2(H_2O) (1) all formulae must be correct before balancing mark awarded			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
9	3	(a)			1	-5 to 40			
		(b)			2	curve drawn from 5°C to 50°C (1) with peak at 30°C (any height) (1)			
		(c)			1	any value of -5°C or below or 55°C or above			

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	4	(a)			4	sulphuric acid: red (1) strong acid (1) ethanoic acid: orange (1) weak acid (1)	 yellow		
		(b)	(i)		3	all points plotted correctly (2) any 8 points plotted correctly (1) smooth curve of 'best fit' (1)			
			(ii)		2	green (1) acid / alkali has been *neutralised* / *all* the acid and alkali have been used up (1)	 solution is neutral / neutralisation has occurred		

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	5	(a)	(i)		1	alkane(s)			
			(ii)		1	alkene(s)			
		(b)	(i)		1	D			
			(ii)		1	C			
		(c)	(i)		1				
			(ii)		2	(compounds that have the) same molecular formula (1) (but) different structural formulae (1)	chemical formula		

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	6	(a)			1	H_2SO_4			
		(b)	(i)		3	all points plotted correctly (2) any four points plotted correctly (1) curve of best fit (1)			
			(ii)	I	1	the higher the temperature, smaller the yield			
				II	1	515 ±5			
			(iii)		3	SO_2 + O_2 (1) SO_3 (1) balancing: 2 : 1 : 2 (1) all formulae must be correct before balancing mark awarded			

Question Number					Mark	Answer	Accept	Neutral answer	Do not accept
FT	HT	Sub-section							
	7	(a)			2	heat until mixture boils / reference to different boiling points e.g. ethanol boils at 80°C and water boils at 100°C / ethanol boils at a lower temperature than water (1) ethanol vapour condenses / cools forming a liquid (1)	vapour cooled and collected		
		(b)			2	Advantages: renewable / carbon-neutral fuel / energy resource Disadvantages: less energy released / need a lot of land (to grow crops) / need a lot of sunlight (to grow crops)	climate might be unsuitable		ref. to 'efficiency'
		(c)	(i)		1	liver disease / stomach problems / throat / affects brain / heart disease / depression			
			(ii)		1	drink driving / road accidents / increase in violent behaviour	domestic violence		alcohol poisoning / death by choking on vomit / depression

Question Number									
FT	HT	Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
	8				4	calculated mean = 25 cm^3 (1) moles = conc × vol/1000 moles = 0.2 × 20/1000 = 0.004 (1) 0.004 : 0.004 (1) conc = 1000/25 × 0.004 = 0.16 (1) correct answer only (4)	alternative method		

WJEC
245 Western Avenue
Cardiff CF5 2YX
Tel No 029 2026 5000
Fax 029 2057 5994
E-mail: exams@wjec.co.uk
website: www.wjec.co.uk