

Mark Scheme (Results)

Summer 2013

International GCSE
Chemistry (4CH0) Paper 1CR

Science Double Award (4SC0)
Paper 1CR

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Question number	Answer	Accept	Reject	Marks
1 (a)	can <u>easily/quickly</u> identify each gas OR <u>less likely</u> to make a mistake in identification I G N O R E just to identify the gas			1
(b) (i)	argon/Ar <u>and</u> helium/He			1
(ii)	oxygen/O ₂ I G N O R E O			1
(iii)	air/it is a mixture (of gases) OR air/it is not a single substance I G N O R E mixture of elements			1
(iv)	not flammable/not explosive/does not burn			1
(c) (i)	hydrogen/H ₂ I G N O R E H	air		1
(ii)	carbon dioxide/CO ₂			1
(iii)	carbon dioxide/CO ₂			1
			Total	8

Question number	Answer	Accept	Reject	Marks
2 (a)	D			1
(b)	M1 before heating – colourless (solution/liquid) IGNORE clear/transparent/looks like water M2 after heating – milky/chalky/cloudy/white (precipitate)/turbid IGNORE references to goes clear OWTTE	no colour	white solution/liquid any colour other than white	1 1
(c)	M1 (sulfur dioxide/it) dissolves in/reacts with (rain) water M2 to form an acidic solution/an acid/sulfurous acid /acid rain IGNORE references to any other products whether correct or not M3 which reacts with/corrodes the marble/calcium carbonate IGNORE erodes / weathers / melts / eats into	SO ₂ + H ₂ O → H ₂ SO ₃ OR SO ₂ + H ₂ O + 1/2O ₂ → H ₂ SO ₄ for both M1 and M2 sulfuric acid <u>chemical</u> weathering dissolves correct equation for reaction with either sulfurous or sulfuric acid SO ₂ reacts with marble for M3 only		1 1 1
			Total	6

Question number	Answer	Accept	Reject	Marks																				
3 (a)	<table border="1"> <thead> <tr> <th>Name of barium salt</th> <th>Formula of barium salt</th> <th>Solubility in water</th> <th>Poisonous</th> </tr> </thead> <tbody> <tr> <td>barium chloride</td> <td>BaCl₂</td> <td></td> <td></td> </tr> <tr> <td>barium nitrate</td> <td></td> <td></td> <td></td> </tr> <tr> <td>barium carbonate</td> <td>BaCO₃</td> <td></td> <td></td> </tr> <tr> <td>barium sulfate</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Name of barium salt	Formula of barium salt	Solubility in water	Poisonous	barium chloride	BaCl ₂			barium nitrate				barium carbonate	BaCO ₃			barium sulfate						1
	Name of barium salt	Formula of barium salt	Solubility in water	Poisonous																				
	barium chloride	BaCl ₂																						
	barium nitrate																							
	barium carbonate	BaCO ₃																						
barium sulfate																								
				1																				
(b)	M1 (it forms) barium chloride/BaCl ₂ /a soluble (barium) salt M2 by reaction/with hydrochloric acid/stomach acid	by neutralisation word or chemical equation for 2 marks (equation can be unbalanced)	any suggestion that barium chloride is reacting	1 1																				
(c)	barium sulfate/BaSO ₄			1																				

Question number	Answer	Accept	Reject	Marks
3 (d)	<p>M1 barium sulfate is formed</p> <p>M2 which is not poisonous/not toxic/harmless I IGNORE references to magnesium hydroxide not poisonous</p> <p>M2 dep on M1</p> <p>M3 barium hydroxide + magnesium sulfate → barium sulfate + magnesium hydroxide</p> <p>OR</p> <p>barium ions + sulfate ions → barium sulfate</p>	<p>'products', provided shown correctly in word equation</p> <p>is insoluble</p> <p>$Ba(OH)_2 + MgSO_4 \rightarrow BaSO_4 + Mg(OH)_2$</p> <p>OR</p> <p>$Ba^{2+} + SO_4^{2-} \rightarrow BaSO_4$</p>		<p>1</p> <p>1</p> <p>1</p>
(e) (i)	<p>M1 water – (reacts) <u>very/extremely</u> quickly/more quickly <u>than strontium</u>/quickest I IGNORE rapidly/vigorously</p> <p>M2 air – (reacts) <u>very/extremely</u> quickly/more quickly <u>than strontium</u>/quickest (without heating) I IGNORE rapidly/vigorously</p>	<p>explosively/violently</p> <p>explosively/violently</p>		<p>1</p> <p>1</p> <p>1</p>
(ii)		in a vacuum		1
(iii)	<p>in/under any one of the following: (paraffin/mineral) oil/petroleum (oil)/(liquid) paraffin I IGNORE in an air tight container</p> <p>reactivity <u>increases</u> as atomic number <u>increases</u></p>	<p>reactivity increases with atomic number/down the group OWTTE reverse argument</p>		1

		positive correlation		
			Total	12

Question number	Answer	Accept	Reject	Marks
4 (a)	M1 (negative electrode) – graphite M2 (positive electrode) – graphite	carbon carbon		2
(b) (i)	it/aluminium oxide/alumina has a (very) high m.pt I IGNORE high b.pt/references to strong bonding/bauxite has a high m.pt/lot of energy needed to melt it		aluminium has a high melting point	1
(ii)	aluminium oxide/alumina is dissolved in/mixed with (molten/liquid) cryolite I IGNORE cryolite lowers the m.pt of aluminium oxide/alumina	added to Na_3AlF_6 for cryolite cryolite is used as the solvent (for aluminium oxide/alumina)	aluminium is dissolved in cryolite	1
(c)	M1 reduction M2 (it/aluminium ions/ Al^{3+}) gain of electron(s) I IGNORE references to loss of oxygen M2 dep on M1	reacts with/combines with decrease in oxidation number/oxidation number changes from +3 to 0	redox for M1 only Al/aluminium gains electrons	1 1
(d)	M1 oxygen formed/produced (at the positive electrode/anode) I IGNORE oxygen from the aluminium oxide M2 reacts with the carbon/the (positive) electrode M2 not dep on M1, but must mention oxygen	oxygen from the electrolysis anode / graphite	any indication that the oxygen is from the air for M1 only cathode/negative electrode	1 1
(e)	Any two from: M1 malleable M2 low density	easy to shape/easy to bend/easy to extrude bend		2

	M3 does not react <u>with food/drink(s)</u> I G N O R E light(er)/high strength to weight ratio/references to cost/lightweight/does not rust	non-toxic/does not corrode		
			Total	10

Question number	Answer	Accept	Reject	Marks
5 (a)	M1 (molecules/compounds/substances) with the same <u>molecular</u> formula/number of each type of atoms I G N O R E chemical formula/same compound	hydrocarbons	elements/atoms general formula/empirical formula for M1 only	1
	M2 (but) different structural formulae/different displayed formulae/different structures	atoms arranged differently		1
(b)	D			1
(c) (i)	M1 C_nH_{2n}	letters other than n, e.g. x	C_n+H_{2n}	1
	(ii) M1 double bond between two left hand end carbon atoms M2 single bond between each pair of rest of carbon atoms Penalise max 1 mark for any extra bond shown			1 1
(d)	M1 addition	additional		1
	M2 orange	yellow/brown	red, either on its own or in combination with any other colour	1
	M3 colourless I G N O R E clear/transparent/looks like water			1
(e)	M1 saturated – <u>all</u> (carbon to carbon) bonds are single <u>/contains only</u> (carbon to carbon)	does not contain any multiple/double bonds		1

	single bonds			1
	M2 unsaturated - contains (carbon to carbon) double/multiple bond(s)			
			Total	11

Question number	Answer	Accept	Reject	Marks
6 (a)	(i) 7			1
	(ii) M1 solid			1
	M2 black	<u>very</u> dark grey		1
	(iii) M1 (formula) – HAt	AtH		1
	M2 (name) – hydrogen astatide	astatine hydride	hydrogen astatine	1
	(iv) M1 – (astatine/it/At) is less reactive (than iodine, I) I IGNORE astatine is unreactive	<u>iodine</u> is more reactive		1
M2 – elements get less reactive with <u>increasing</u> atomic number/as group is <u>descended</u> /the lower they are in the group	reverse argument Astatine (atom) has more (electron) shells/outer shell of astatine is further from nucleus so attracts an <u>electron</u> less readily	any references to astatide or iodide	1	
(b) (i)	4 (1) (1) 2 (1)	multiples/halves		1
(ii)	(paper) turns white/bleaches I IGNORE turns red	(litmus) turns colourless		1
(c)	(i) acid I IGNORE hydrogen ions/names of acids	correct formula		1
	(ii) to displace (all of) the <u>bromine</u> / to react all of the <u>bromide</u> (ions)	bromine (an) <u>ions</u> for bromide to complete the reaction		1
	(iii) $\text{Br}_2 + \text{SO}_2 + 2\text{H}_2\text{O} \rightarrow 2\text{HBr} + \text{H}_2\text{SO}_4$ M1 all formulae correct M2 balanced	multiples and halves		2
	(iv) $2\text{HBr} + \text{Cl}_2 \rightarrow \text{Br}_2 + 2\text{HCl}$	multiples and halves		1

(d)	M1 colourless I IGNORE clear/transparent/looks like water	red- brown/orange/orange- brown	red on its own	1
	M2 brown (solution) / (dark) grey/black <u>solid/precipitate</u>			1
			Total	16

Question number	Answer	Accept	Reject	Marks
7 (a)	M1 (reactants) s aq	capital letters		1
	M2 (products) aq l g			1
(b) (i)	to prevent acid escaping/spraying out/spitting out I IGNORE to prevent water escaping	solution/liquid/HCl		1
	(ii) C			1
(c) (i)	M1 A	reaction is faster		1
	M2 gas produced/collected more quickly / experiment over in shorter time / (gradient of) line steeper M2 dep on M1			1
(ii)	M1 0.1(0)	Half the products are produced		1
	M2 volume of gas is half/ $40 \div 80 = \frac{1}{2} / 80 = 40$ x 2 M2 dep on M1			
(d) (i)	M1 & M2 - all points plotted to nearest gridline deduct 1 mark for each incorrect plot up to a max. of 2			2
	M3 suitable straight line of best fit (csq on plotted points) (must be drawn with the aid of a ruler). Line need not be extrapolated.			1
(ii)	M1 as concentration increases rate increases	(show a) <u>positive</u> correlation as one doubles the other doubles/directly proportional		1

(iii)	M2 proportional / in proportion M1 more ions/particles (in a given volume) IGNORE more reactants M2 collide (successfully) M3 more per second/more frequently Must be reference to frequency or number of collisions per unit time IGNORE greater chance of collision	for 2 marks	molecules/atoms any reference to greater energy	1 1 1
			Total	16

Question number	Answer	Accept	Reject	Marks
8 (a)	(i) Impurities/chemicals/substances may affect the colour/flame IGNORE affect the result/test			1
	(ii) colour can (easily) be seen (in a non-luminous flame) IGNORE references to temperature	a luminous flame may mask the colour		1
	(iii) yellow/orange/gold(en)	any combination of the acceptable colours, e.g. golden-yellow		1
(b)	(i) Li^+ and Ca^{2+}	lithium and calcium/Li and Ca	Ca^+ etc	1
	(ii) M1 – ammonia/ NH_3			1
	M2 – (water is needed) to form hydroxide ions/ OH^-	to form an alkali/an alkaline solution/ammonium hydroxide		1
	(iii) M1 – iron(III)/ Fe^{3+}	to dissolve the ammonia ammonia needs to be aqueous	any other oxidation states/ferrous	1
	M2 – ammonium/ NH_4^+	ferric	ammonia	1
	If both names and formulae given both must be correct			
			Total	8

Question number	Answer	Accept	Reject	Marks
9 (a)	(i) measuring cylinder			1
	(ii) M1 44	answers in other correct units, e.g. 0.044 dm ³ ml 0.44 for 1 mark only correct answer with no working for 2 marks	0.0004	1
	M2 cm ³			1
	(iii) M1 $\frac{44 \times 0.01(0)}{1000}$			1
	M2 0.00044(0)			1
Mark csq on answer to (a)(ii)				
(b)	<u>zinc</u> because M1 1 mol zinc reacts with 2 mol HCl M2 only 0.005 mol of zinc are needed M1 is standalone M2 is dep on zinc given as being in excess			1 1
(c)	(i) (rate) increases/faster reaction	less time for reaction to take place	faster time	1
	(ii) no effect/same volume (of hydrogen) produced	none/no change		1
			Total	9

Question number	Answer	Accept	Reject	Marks
10 (a)	<p>any two from:</p> <ul style="list-style-type: none"> • forward and backward reactions (still) occurring • concentrations/amounts of reactants/products/components remain constant • rate of forward reaction = rate of reverse reaction <p>IGNORE concentrations/amounts of reactants and products are the same IGNORE reaction is reversible/goes both ways, OWTTE IGNORE references to le Chatelier</p>	<p>both reactions (still) occurring</p> <p>stay the same in place of remain constant</p>		2
(b) (i)	<p>M1 – (increase in temperature) decrease(s)</p> <p>M2 – (increase in pressure) increase(s)</p>	<p>less/<u>low</u>er(s)/drop(s)/gets smaller</p>		1
(ii)	<p>M1 – (forward) reaction is exothermic/gives out heat</p> <p>OR</p> <p><u>reverse</u> reaction is endothermic/takes in heat</p> <p>M2 – fewer (gas) molecules/particles on right hand side</p> <p>OR fewer moles (of gas) on right hand side</p> <p>IGNORE references to volumes IGNORE references to le Chatelier’s principle IGNORE references to reverse reaction lowers the temperature IGNORE references to forward reaction reduces the pressure</p>	<p>more/<u>rais</u>e(s)/high<u>er</u>/gets bigger</p> <p>reverse argument shifts to side with fewer (gas) molecules/fewer moles (of gas)</p>	atoms	1

10	(c)	(i)	(the position of) equilibrium is not established/reached			1
		(ii)	M1 – (the mixture of gases is) cooled	temperature is decreased		1
		(iii)	M2 – ammonia liquefies / condenses recycled / <u>re</u> used / recirculated	put (back) into the reaction chamber used <u>again</u> (in the process)		1
	(d)		<u>heat(ing)</u> / <u>energy</u> costs would be higher	yield (of ammonia) would decrease		1
	(e)	(i)	M1 $M_r(N_2) = 28$	28 anywhere in the calculation		1
			M2 $112\,000 \div 28 (= 4\,000) / 112\,000 \div M1$ M3 $8\,000 / M2 \times 2$	112 \div 28) $\times 2 = 8$ for 2 marks (112 000 \div 14) $\times 2 = 16\,000$ for 2 marks Correct final answer without working for 3 marks		1
		(ii)	1 200 / 15% of M3			1
Total						15

Question number	Answer	Accept	Reject	Marks
11 (a)	(produces) <u>most</u> heat/energy <u>per gram</u> / <u>per unit mass</u>	<u>highest</u> temperature rise <u>per gram</u> / <u>per unit mass</u> <u>most</u> energy for <u>smallest</u> number of <u>grams</u> / <u>mass</u>	per amount	1
(b)	(produces) <u>most</u> heat/energy <u>per mole</u> /per <u>molecule</u> / <u>per amount</u>	<u>highest</u> temperature rise <u>per mole</u> / <u>per molecule</u> <u>most</u> energy for <u>smallest</u> number of <u>moles</u> / <u>molecules</u> / <u>amount</u>		1
(c)	Any two from: <ul style="list-style-type: none"> • heat/energy losses (e.g. by convection, by conduction, to air, to surroundings) • incomplete combustion • evaporation of water • copper / can / beaker / thermometer /apparatus absorbs heat • flame moves around because of draughts 	<ul style="list-style-type: none"> • non-standard conditions 		2
(d) (i)	A			1
(ii)	B			1
(e)	M1 breaking bonds is endothermic / takes in heat/energy M2 making bonds is exothermic / gives out heat/energy M3 more heat/energy given out than taken in	more energy is given out when bonds are made than is taken in when bonds are broken for 3 marks more energy is given out when bonds are made than when bonds are broken for 1 mark		1 1 1

	IGNORE references to numbers/strengths of bonds			
			Total	9

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