

# 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  <b>IGNORE</b> just to identify the gas			1
(b) (i)	argon/Ar <u>and</u> helium/He			1
(ii)	oxygen/O <sub>2</sub> <b>IGNORE</b> O			1
(iii)	air/it is a mixture (of gases) OR air/it is not a single substance <b>IGNORE</b> mixture of elements			1
(iv)	not flammable/not explosive/does not burn			1
(c) (i)	hydrogen/H <sub>2</sub> <b>IGNORE</b> H	air		1
(ii)	carbon dioxide/CO <sub>2</sub>			1
(iii)	carbon dioxide/CO <sub>2</sub>			1
			<b>Total</b>	<b>8</b>

Question number	Answer	Accept	Reject	Marks
2 (a)	D			1
(b)	<p><b>M1</b> before heating – colourless (solution/liquid) <b>IGNORE</b> clear/transparent/looks like water</p> <p><b>M2</b> after heating – milky/chalky/cloudy/white (precipitate)/turbid</p> <p><b>IGNORE</b> references to goes clear OWTTE</p>	no colour	white solution/liquid any colour other than white	1  1
(c)	<p><b>M1</b> (sulfur dioxide/it) dissolves in/reacts with (rain) water</p> <p><b>M2</b> to form an acidic solution/an acid/sulfurous acid /acid rain <b>IGNORE</b> references to any other products whether correct or not</p> <p><b>M3</b> which reacts with, corrodes the marble/calcium carbonate</p> <p><b>IGNORE</b> erodes / weathers / melts / eats into</p>	<p><math>\text{SO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_3</math> OR <math>\text{SO}_2 + \text{H}_2\text{O} + \frac{1}{2}\text{O}_2 \rightarrow \text{H}_2\text{SO}_4</math> for both <b>M1</b> and <b>M2</b></p> <p>sulfuric acid</p> <p><u>chemical</u> weathering dissolves correct equation for reaction with either sulfurous or sulfuric acid</p> <p><math>\text{SO}_2</math> reacts with marble for M3 only</p>		1  1  1
			<b>Total</b>	<b>6</b>

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>BaCl<sub>2</sub></td> <td></td> <td></td> </tr> <tr> <td>barium nitrate</td> <td></td> <td></td> <td></td> </tr> <tr> <td>barium carbonate</td> <td>BaCO<sub>3</sub></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 <sub>2</sub>			barium nitrate				barium carbonate	BaCO <sub>3</sub>			barium sulfate						1
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barium sulfate																								
				1																				
(b)	<p><b>M1</b> (it forms) barium chloride/BaCl<sub>2</sub>/a soluble (barium) salt</p> <p><b>M2</b> by reaction/with hydrochloric acid/stomach acid</p>	<p>by neutralisation</p> <p>word or chemical equation for 2 marks (equation can be unbalanced)</p>	<p>any suggestion that barium chloride is reacting</p>	1																				
(c)	barium sulfate/BaSO <sub>4</sub>			1																				

Question number	Answer	Accept	Reject	Marks
3 (d)	<p><b>M1</b> barium sulfate is formed</p> <p><b>M2</b> which is not poisonous/not toxic/harmless <b>IGNORE</b> references to magnesium hydroxide not poisonous</p> <p><b>M2</b> dep on <b>M1</b></p> <p><b>M3</b> 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><math>\text{Ba}(\text{OH})_2 + \text{MgSO}_4 \rightarrow \text{BaSO}_4 + \text{Mg}(\text{OH})_2</math></p> <p>OR</p> <p><math>\text{Ba}^{2+} + \text{SO}_4^{2-} \rightarrow \text{BaSO}_4</math></p>		<p>1</p> <p>1</p> <p>1</p>
(e) (i)	<p><b>M1</b> water – (reacts) <u>very/extremely</u> quickly/more quickly than <u>strontium/quickest</u> <b>IGNORE</b> rapidly/vigorously</p> <p><b>M2</b> air – (reacts) <u>very/extremely</u> quickly/more quickly than <u>strontium/quickest</u> (without heating) <b>IGNORE</b> rapidly/vigorously</p>	<p>explosively/violently</p> <p>explosively/violently</p>		<p>1</p> <p>1</p> <p>1</p>
(ii)	<p>in/under any one of the following: (paraffin/mineral) oil/petroleum (oil)/(liquid) paraffin</p>	<p>in a vacuum</p>		<p>1</p>
(iii)	<p><b>IGNORE</b> in an airtight 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>		<p>1</p>

		positive correlation		
			<b>Total</b>	<b>12</b>

Question number	Answer	Accept	Reject	Marks
4 (a)	<b>M1</b> (negative electrode) – graphite <b>M2</b> (positive electrode) – graphite	carbon carbon		2
(b) (i)	it/aluminium oxide/alumina has a (very) high m.pt <b>IGNORE</b> 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 <b>IGNORE</b> cryolite lowers the m.pt of aluminium oxide/alumina	added to $\text{Na}_3\text{AlF}_6$ for cryolite cryolite is used as the solvent (for aluminium oxide/alumina)	aluminium is dissolved in cryolite	1
(c)	<b>M1</b> reduction <b>M2</b> (it/aluminium ions/ $\text{Al}^{3+}$ ) gain of electron(s) <b>IGNORE</b> references to loss of oxygen <b>M2</b> dep on <b>M1</b>	reacts with/combines with decrease in oxidation number/oxidation number changes from +3 to 0	redox for <b>M1</b> only Al/aluminium gains electrons	1 1
(d)	<b>M1</b> oxygen formed/produced (at the positive electrode/anode) <b>IGNORE</b> oxygen from the aluminium oxide <b>M2</b> reacts with the carbon/the (positive) electrode <b>M2</b> not dep on <b>M1</b> , but must mention oxygen	oxygen from the electrolysis anode / graphite	any indication that the oxygen is from the air for <b>M1</b> only cathode/negative electrode	1 1
(e)	Any two from: <b>M1</b> malleable <b>M2</b> low density	easy to shape/easy to bend/easy to extrude bend		2

	<b>M3</b> does not react <u>with food/drink(s)</u> <b>IGNORE</b> light(er)/high strength to weight ratio/references to cost/lightweight/does not rust	non-toxic/does not corrode		
			<b>Total</b>	<b>10</b>

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

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

Question number	Answer	Accept	Reject	Marks
6 (a) (i)	7			1
(ii)	<b>M1</b> solid <b>M2</b> black	<u>very</u> dark grey		1 1
(iii)	<b>M1</b> (formula) – HAt <b>M2</b> (name) – hydrogen astatide	AtH astatine hydride	hydrogen astatine	1 1
(iv)	<b>M1</b> – (astatine/it/At) is less reactive (than iodine, I) <b>IGNORE</b> astatine is unreactive <b>M2</b> – elements get less reactive with <u>increasing</u> atomic number/as group is <u>descended</u> /the lower they are in the group	<u>iodine</u> is more reactive 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 1
(b) (i)	4 (1) (1) 2 (1)	multiplies/halves		1
(ii)	(paper) turns white/bleaches <b>IGNORE</b> turns red	(litmus) turns colourless		1
(c) (i)	acid <b>IGNORE</b> 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)	$\text{Br}_2 + \text{SO}_2 + 2\text{H}_2\text{O} \rightarrow 2\text{HBr} + \text{H}_2\text{SO}_4$ <b>M1</b> all formulae correct <b>M2</b> balanced	multiplies and halves		2
(iv)	$2\text{HBr} + \text{Cl}_2 \rightarrow \text{Br}_2 + 2\text{HCl}$	multiplies and halves		1

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

Question number	Answer	Accept	Reject	Marks
7 (a)	<b>M1</b> (reactants) s aq <b>M2</b> (products) aq l g	capital letters		1 1
(b) (i)	to prevent acid escaping/spraying out/spitting out <b>IGNORE</b> to prevent water escaping	solution/liquid/HCl		1
(ii)	C			1
(c) (i)	<b>M1</b> A <b>M2</b> gas produced/collected more quickly / experiment over in shorter time / (gradient of) line steeper <b>M2</b> dep on <b>M1</b>	reaction is faster		1 1 1
(ii)	<b>M1</b> 0.1(0) <b>M2</b> volume of gas half/40 ÷ 80 = ½ / 80 = 40 x 2 <b>M2</b> dep on <b>M1</b>	Half the products are produced		1
(d) (i)	<b>M1 &amp; M2</b> - all points plotted to nearest gridline deduct 1 mark for each correct plot up to a max. of 2 <b>M3</b> suitable straight line of best fit (csq on plotted points) (must be drawn with the aid of a ruler). Line need not be extrapolated.			2 1 1
(ii)	<b>M1</b> as concentration increases rate increases	(show a ) <u>positive</u> correlation  as one doubles the other doubles/directly proportional		1 1

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

Question number	Answer	Accept	Reject	Marks
8 (a) (i)	Impurities/chemicals/substances may affect the colour/flame <b>IGNORE</b> affect the result/test			1
(ii)	colour can (easily) be seen (in a non-luminous flame) <b>IGNORE</b> 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 <sup>+</sup> and Ca <sup>2+</sup>	lithium and calcium/Li and Ca	Ca <sup>+</sup> etc	1
(ii)	<b>M1</b> – ammonia/NH <sub>3</sub> <b>M2</b> – (water is needed) to form hydroxide ions/OH <sup>-</sup>	to form an alkali/an alkaline solution/ammonium hydroxide		1
(iii)	<b>M1</b> – iron(III)/Fe <sup>3+</sup> <b>M2</b> – ammonium/NH <sub>4</sub> <sup>+</sup> If both names and formulae given both must be correct	to dissolve the ammonia ammonia needs to be aqueous  ferric	any other oxidation states/ferrous  ammonia	1  1
			<b>Total</b>	<b>8</b>

Question number	Answer	Accept	Reject	Marks
9 (a)	(i) measuring cylinder			1
	(ii) <b>M1</b> 44	answers in other correct units, e.g. 0.044 dm <sup>3</sup>  ml    0.44 for 1 mark only correct answer with no working for 2 marks		1
	<b>M2</b> cm <sup>3</sup>			1
	(iii) <b>M1</b> $\frac{44 \times 0.01(0)}{1000}$			1
	<b>M2</b> 0.00044(0)		0.0004	1
Mark csq on answer to (a)(ii)				
(b)	<u>zinc</u> because  <b>M1</b> 1 mol zinc reacts with 2 mol HCl  <b>M2</b> only 0.005 mol of zinc are needed  <b>M1</b> is standalone <b>M2</b> 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
			<b>Total</b>	<b>9</b>

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

10	(c)	(i)	(the position of) equilibrium is not established/reached			1
		(ii)	<b>M1</b> – (the mixture of gases is) cooled	temperature is decreased		1
		(iii)	<b>M2</b> – 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)	<b>M1</b> $M_r(\text{N}_2) = 28$ <b>M2</b> $112\,000 \div 28 (= 4\,000) / 112\,000 \div$ <b>M1</b> <b>M3</b> $8\,000 / \mathbf{M2} \times 2$	28 anywhere in the calculation  $112 \div 28) \times 2 = 8$ for 2 marks  $(112\,000 \div 14) \times 2 = 16\,000$ for 2 marks  Correct final answer without working for 3 marks		1 1 1
		(ii)	1 200 / 15% of <b>M3</b>			1
<b>Total</b>						<b>15</b>

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> / <u>per 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"> <li>● heat/energy losses (e.g. by convection, by conduction, to air, to surroundings)</li> <li>● incomplete combustion</li> <li>● evaporation of water</li> <li>● copper / can / beaker / thermometer /apparatus absorbs heat</li> <li>● flame moves around because of draughts</li> </ul>	<ul style="list-style-type: none"> <li>● non-standard conditions</li> </ul>		2
(d) (i)	A			1
(ii)	B			1
(e)	<p><b>M1</b> breaking bonds is endothermic / takes in heat/energy</p> <p><b>M2</b> making bonds is exothermic / gives out heat/energy</p> <p><b>M3</b> more heat/energy given out than taken in</p>	<p>more energy is given out when bonds are made than is taken in when bonds are broken for 3 marks</p> <p>more energy is given out when bonds are made than when bonds are broken for 1 mark</p>		1 1 1

	<b>IGNORE</b> references to numbers/strengths of bonds			
			<b>Total</b>	<b>9</b>



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