Mark Scheme (Results)

Summer 2013

International GCSE
Chemistry (4CH0) Paper 1CR

Science Double Award (4SC0)
Paper 1CR

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Summer 2013
Publications Code UG035595

Question number	Answer	Accept	Reject	Marks
1 (a)	can <u>easily</u>/<u>quickly</u> identify each gas OR <u>less likely</u> to make a mistake in identification **IGNORE** just to identify the gas			1
(b) (i)	argon/Ar <u>and</u> helium/He			1
(ii)	oxygen/O_2 **IGNORE** O			1
(iii)	air/it is a mixture (of gases) OR air/it is not a single substance **IGNORE** mixture of elements			1 1
(iv)	not flammable/not explosive/does not burn			
(c) (i)	hydrogen/H_2 **IGNORE** 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	$SO_2 + H_2O \rightarrow H_2SO_3$ OR $SO_2 + H_2O + ½O_2 \rightarrow H_2SO_4$ 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**

<table>
<tr><th>Question number</th><th>Answer</th><th>Accept</th><th>Reject</th><th>Marks</th></tr>
<tr><td>3 (a)</td><td>
<table>
<tr><th>Name of barium salt</th><th>Formula of barium salt</th><th>Solubility in water</th><th>Poisonous</th></tr>
<tr><td>barium chloride</td><td>$BaCl_2$</td><td></td><td></td></tr>
<tr><td>barium nitrate</td><td></td><td></td><td></td></tr>
<tr><td>barium carbonate</td><td>$BaCO_3$</td><td></td><td></td></tr>
<tr><td>barium sulfate</td><td></td><td></td><td></td></tr>
</table>
</td><td></td><td></td><td>1

1</td></tr>
<tr><td>(b)</td><td>M1 (it forms) barium chloride/$BaCl_2$/a soluble (barium) salt

M2 by reaction/with hydrochloric acid/stomach acid</td><td>

by neutralisation

word or chemical equation for 2 marks (equation can be unbalanced)</td><td>

any suggestion that barium chloride is reacting</td><td>1

1</td></tr>
<tr><td>(c)</td><td>barium sulfate/$BaSO_4$</td><td></td><td></td><td>1</td></tr>
</table>

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

		positive correlation		
			Total	**12**

Question number	Answer	Accept	Reject	Marks
4 (a)	**M1 (n**egative electrode) – graphite **M2** (positive electrode) – graphite	carbon carbon		2
(b) (i)	it/aluminium oxide/alumina has a (very) high m.pt **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 **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) **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) **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> **IGNORE** 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	hydrocarbons	elements/atoms general formula/empirical formula for **M1** only	1
	IGNORE chemical formula/same compound	atoms arranged differently		1
	M2 (but) different structural formulae/different displayed formulae/different structures			
(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			1
	M2 single bond between each pair of rest of carbon atoms			1
	Penalise max 1 mark for any extra bond shown			
(d)	**M1** addition	additional		1
	M2 orange	yellow/brown	red, either on its own or in combination with any other colour	1
	M3 colourless **IGNORE** clear/transparent/looks like water			1
(e)	**M1** 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 **M2** unsaturated - contains (carbon to carbon) double/multiple bond(s)			1
			Total	**11**

Question number	Answer	Accept	Reject	Marks
6 (a) (i)	7			1
(ii)	**M1** solid			1
	M2 black	very 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) **IGNORE** astatine is unreactive	iodine is more reactive reverse argument	any references to astatide or iodide	1 1
	M2 – elements get less reactive with increasing atomic number/as group is descended/the lower they are in the group	Astatine (atom) has more (electron) shells/outer shell of astatine is further from nucleus so attracts an electron less readily		1
(b) (i)	4 (1) (1) 2 (1)	multiples/halves		1
(ii)	(paper) turns white/bleaches **IGNORE** turns red	(litmus) turns colourless		1
(c) (i)	acid **IGNORE** hydrogen ions/names of acids	correct formula		1 1
(ii)	to displace (all of) the bromine / to react all of the bromide (ions)	bromine (an)ions for bromide to complete the reaction		2
(iii)	$Br_2 + SO_2 + 2H_2O \rightarrow 2HBr + H_2SO_4$ **M1** all formulae correct **M2** balanced	multiples and halves		
(iv)	$2HBr + Cl_2 \rightarrow Br_2 + 2HCl$	multiples and halves		1

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

Question number	Answer	Accept	Reject	Marks
7 (a)	**M1** (reactants) s aq **M2** (products) aq l g	capital letters		1 1
(b) (i)	to prevent acid escaping/spraying out/spitting out **IGNORE** to prevent water escaping	solution/liquid/HCl		1
(ii)	C			1
(c) (i)	**M1** A **M2** gas produced/collected more quickly / experiment over in shorter time / (gradient of) line steeper **M2** dep on **M1**	reaction is faster		1 1 1
(ii)	**M1** 0.1(0) **M2** volume of gas is half/40 ÷ 80 = ½ / 80 = 40 x 2 **M2 dep on M1**	Half the products are produced		1
(d) (i)	**M1** & **M2** - all points plotted to nearest gridline deduct 1 mark for each incorrect plot up to a max. of 2			2 1
(ii)	**M3** suitable straight line of best fit (csq on plotted points) (must be drawn with the aid of a ruler). Line need not beextrapolated. **M1** as concentration increases rate increases	(show a) <u>positive</u> correlation as one doubles the other doubles/directly proportional		1 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^+ If both names and formulae given both must be correct	ferric	ammonia	1
			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		1
	M2 cm^3	ml		1
(iii)	**M1** $\frac{44 \times 0.01(0)}{1000}$			1
	M2 0.00044(0)		0.0004	1
	Mark csq on answer to (a)(ii)	0.44 for 1 mark only correct answer with no working for 2 marks		
(b)	zinc because			
	M1 1 mol zinc reacts with 2 mol HCl			1
	M2 only 0.005 mol of zinc are needed			1
	M1 is standalone **M2** is dep on zinc given as being in excess			
(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)	any two from: ● forward and backward reactions (still) occurring ● concentrations/amounts of reactants/products/components remain constant ● rate of forward reaction = rate of reverse reaction **IGNORE** concentrations/amounts of reactants and products are the same **IGNORE** reaction is reversible/goes both ways, OWTTE **IGNORE** references to le Chatelier	both reactions (still) occurring stay the same in place of remain constant		2
(b) (i)	**M1** – (increase in temperature) decrease(s)	less/lower(s)/drop(s)/gets smaller		1
	M2 – (increase in pressure) increase(s)	more/raise(s)/higher/gets bigger		1
(ii)	**M1** – (forward) reaction is exothermic/gives out heat OR reverse reaction is endothermic/takes in heat			1
	M2 – fewer (gas) molecules/particles on right hand side OR fewer moles (of gas) on right hand side **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	reverse argument shifts to side with fewer (gas) molecules/fewer moles (of gas)	atoms	1

10 (c) (i)	(the position of) equilibrium is not established/reached				1
(ii)	**M1** – (the mixture of gases is) cooled **M2** – ammonia liquefies / condenses	temperature is decreased			1 1
(iii)	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 **M2** 112 000 ÷ 28 (= 4 000) / 112 000 ÷ **M1** **M3** 8 000 / **M2** x 2	28 anywhere in the calculation 112 ÷ 28) x 2 = 8 for 2 marks (112 000 ÷ 14) x 2 = 16 000 for 2 marks Correct final answer without working for 3 marks			1 1 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>/<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: ● 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	● 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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