Mark Scheme (Results)

Summer 2013

International GCSE
Chemistry (4CH0) Paper 1CR

Science Double Award (4SC0)
Paper 1CR

Edexcel and BTEC Qualifications
Edexcel and BTEC qualifications come from Pearson, the world's leading learning company. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk for our BTEC qualifications.
Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

If you have any subject specific questions about this specification that require the help of a subject specialist, you can speak directly to the subject team at Pearson.
Their contact details can be found on this link: www.edexcel.com/teachingservices.

You can also use our online Ask the Expert service at www.edexcel.com/ask. You will need an Edexcel username and password to access this service.

Pearson: helping people progress, everywhere
Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

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) <u>very/extremely</u> quickly/more quickly <u>than strontium</u>/quickest **IGNORE** rapidly/vigorously	explosively/violently		1
	M2 air – (reacts) <u>very/extremely</u> quickly/more quickly <u>than strontium</u>/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 <u>increases</u> as atomic number <u>increases</u>	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)	<u>zinc</u> 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) most heat/energy per gram / per unit mass	highest temperature rise per gram / per unit mass most energy for smallest number of grams / mass	per amount	1
(b)	(produces) most heat/energy per mole/per molecule /per amount	highest temperature rise per mole / per molecule most energy for smallest number of moles / molecules / amount		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) (ii)	A B			1 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**

Further copies of this publication are available from
Edexcel Publications, Adamsway, Mansfield, Notts, NG18 4FN

Telephone 01623 467467
Fax 01623 450481
Email publication.orders@edexcel.com

Order Code xxxxxxxx Summer 2013

For more information on Edexcel qualifications, please visit our website
www.edexcel.com

Ofqual

Llywodraeth Cynulliad Cymru
Welsh Assembly Government

Rewarding Learning