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Mark Scheme (Results)

January 2014

International GCSE
Chemistry (4CH0) Paper 1C
Science Double Award (4SC0) Paper 1C

Edexcel Level 1/Level 2 Certificates
Chemistry (KCH0) Paper 1C
Science (Double Award) (KSC0) Paper 1C

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General Marking Guidance

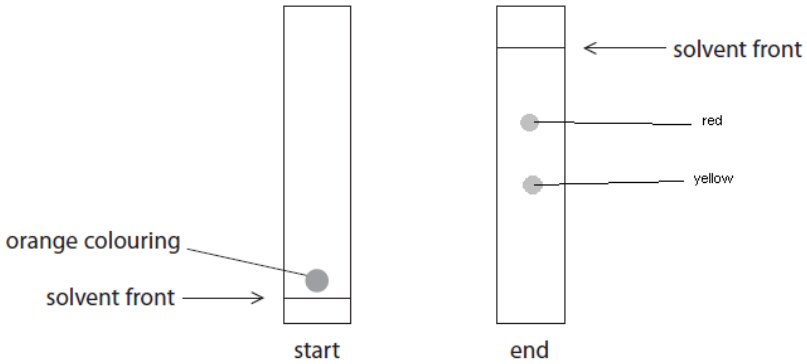
- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question number	Answer	Accept	Reject	Marks
1	**M1** dissolve			1
	M2 solution			1
	M3 evaporate			1
	M4 crystals			1
	M5 filter			1
			Total	**5**

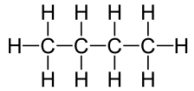
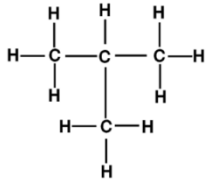
Question number	Answer	Accept	Reject	Marks
2 (a)	X boiling			1
	Y condensing			1
	Z freezing			1
(b)	C The particles move freely.			1
(c) (i)	thermometer			1
(ii)	it/water boils at 100ºC	water does not get hotter than 100ºC		1
	OR			
	it/water boils below the melting point of (solid) Q / 140ºC / boils before Q melts **IGNORE** evaporates	reverse argument		
(iii)	to keep the liquid at an even/equal temperature (throughout)	OWTTE	words that imply constant temperature, eg steady	1
	OR			
	to avoid the <u>bottom</u> of the liquid from overheating/the <u>bottom</u> getting hotter than the rest of the liquid/to evenly distribute the heat/to avoid hot spots **IGNORE** references to increasing movement, etc of particles			
			Total	**7**

Question number	Expected Answer	Accept	Reject	Marks
3 (a)(i)	nitrogen <u>and</u> oxygen IGNORE formulae whether right or wrong			1
(ii)	argon IGNORE formula whether right or wrong			1
(b)	Any one from: • manufacture of ammonia/in the Haber process • food packaging/preservative • aircraft tyres • (in) light bulbs • coolant/refrigerant/freezing agent • treatment of warts			1
(c)	Any one from: • sulfur dioxide • nitrogen monoxide • nitrogen dioxide • dinitrogen tetr(a)oxide • oxide(s) of nitrogen If both a name and a formula are given, **IGNORE** the formula **IGNORE** carbon dioxide	nitrogen oxide a correct formula	any other gas	1

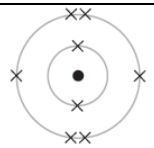
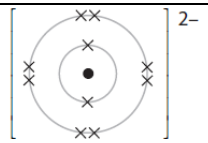
(d)	(i)	iron + oxygen (+ water) → (hydrated) iron (III) oxide **M1** lhs **M2** rhs	ferric oxide/iron oxide correct chemical equation M1 all formulae correct M2 balanced	any other oxidation state	2
	(ii)	**M1** volume of oxygen = 80 – 63 / 17 (cm^3)			1
		M2 percentage = ($\frac{17}{80}$ × 100) / 21 OR $\frac{M1}{80}$ × 100 correctly evaluated 21 with no working scores 1 78.75/78.8/78.7 with no working scores 1 $\frac{63}{80}$ × 100 = 79 scores 1 79 with no working scores 0	21.25 / 21.3/21.2		1
(e)		(whether it/the height / the measurement is) the same as before **IGNORE** references to iron had stopped rusting	no change		1
				Total	**9**

Question number	Answer	Accept	Reject	Marks
4 (a) (i)	the (orange) colouring dissolves in ethanol / does not dissolve in water **OR** the (orange) colouring is more soluble in ethanol (than water) **OR** ethanol is a better solvent (than water) **IGNORE** petals dissolve			1
(ii)	water bath / electric heater / isomantle	description of water bath hot water/steam		1
(iii)	filter / decant / pour off the liquid	use a sieve		1
(b)	**M1** 2 spots/dots/circles drawn at <u>different</u> heights above the original orange spot <u>and</u> <u>below</u> the solvent front **M2** one spot labelled red AND one spot labelled yellow i.e.  	one spot level with the orange spot		1 1
			Total	**5**

Question number	Answer	Accept	Reject	Marks
5 (a)	**A** - (tap) funnel	burette		1
	B - (conical) flask			1
	C - (gas) jar	measuring cylinder		1
(b)	**M1** (limewater) goes milky/chalky/cloudy OR (white) precipitate/solid/suspension (formed)	ppt	colours other than white	1
	M2 (mixture) goes clear OWTTE (eg cloudiness disappears) **IGNORE** bubbles	solid dissolves OWTTE colourless solution (formed)		1
(c)	more dense than air/oxygen	poor conductor of electricity	just heavier than air	1
(d)	**C** weakly acidic			1
			Total	**7**

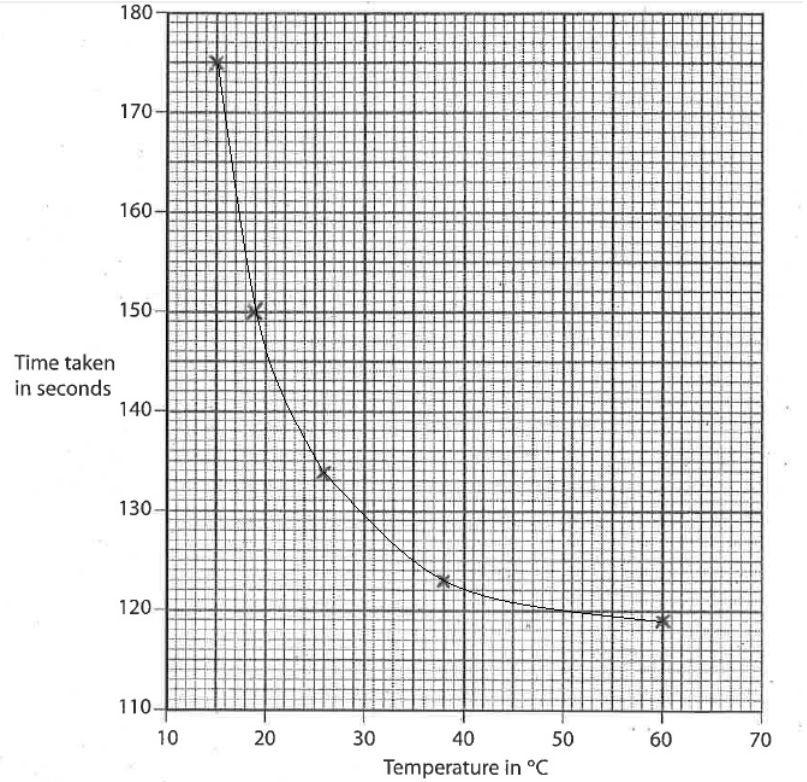
Question number	Answer	Accept	Reject	Marks
6 (a)	**M1** C_6H_{14} **M2** 58 **M3** any value in the range 25 to 45			1 1 1
(b)	boiling point/it <u>increases</u> as M_r <u>increases</u>	reverse argument positive correlation as one increases the other increases	directly proportional	1
(c)	different <u>general</u> formulae / **OR** (general) formula of ethene is <u>not</u> C_nH_{2n+2} / (general) formula of ethane is <u>not</u> C_nH_{2n} **OR** use of/ mention of displayed formulae to show/indicate double (C to C) bond in ethene <u>and</u> single (C to C) bond in ethane	same number of carbon atoms but different number of hydrogen atoms	just different number of hydrogen atoms	1
(d) (i)	**M1**  **M2**  penailse one missng H or one missing bond once only accept answers in either order			1 1
(ii)	(structural) isomer(s)	isomerism		1

6 (e) (i)	$C_2H_6 + Br_2 \rightarrow C_2H_5Br + HBr$ **M1** – C_2H_5Br **M2** – rest of equation correct **M2** dep on **M1** **IGNORE** state symbols	further substituted formula structural or displayed formulae		2
(ii)	substitution	bromination/halogenation		1
(iii)	ultraviolet/uv (radiation)	uv light sunlight	light on its own	1
			Total	**12**

Question number	Answer	Accept	Reject	Marks
7 (a)	releases thermal energy	releases heat (energy) produces an increase in temperature	just releases energy	1
(b)	D 			1
(c)	A 			1
(d)	**M1** (consists of) positive <u>AND</u> negative/oppositely charged ions/Mg^{2+} <u>AND</u> O^{2-} (ions) **IGNORE** references to loss and gain of electrons **M2** (strong) attraction between (positive <u>AND</u> negative/ oppositely charged) ions/Mg^{2+} <u>AND</u> O^{2-} (ions) **M3** many ions (present in lattice)/giant structure/giant lattice **M4** large amount of energy required (to separate the ions/overcome the attraction between the ions) If mention of covalent bonds/metallic bonds/intermolecular forces only **M4** can be awarded	(strong) ionic bonding/(strong) ionic bonds break the ionic bonding/bonds		4
7 (e)	**M1** (name) magnesium chloride **M2** (formula) $MgCl_2$ Penalise inappropriate use of upper or lower case letters or numbers in the wrong place	accept a correct formula as a <u>product</u> in an equation whether the equation correct or not		1 1
			Total	**9**

Question number	Answer	Accept	Reject	Marks
8 (a)	**M1** electronic configuration / 2.1, 2.8.1, 2.8.8.1 **M2** same number of electrons in outer shell / one electron in outer shell **OR** the number of electrons in the outer shell determines the chemical properties	electronic structure / arrangement of electrons		1 1
(b)	melting point / melting temperature			1
(c) (i)	burns with a pop/squeak (when mixed with air and ignited)	use burning/lit spill / flame to see if pop/squeak splint for spill	glowing spill just 'squeaky pop test'	1
(ii)	s l aq g	capital letters		1
(iii)	**M1** turns blue **IGNORE** purple **M2** alkaline solution formed/alkali formed/hydroxide ions formed/LiOH is an alkali/LiOH forms hydroxide ions **IGNORE** references to lithium hydroxide is a metal hydroxide **M2** dep on **M1** correct or missing	OH^- for hydroxide ions pH is greater than 7		1 1

	(d)	Similarities - any two from: • floats • moves around • fizzes/effervesces/bubbles/produces gas/produces hydrogen • disappears/dissolves • forms a solution Differences – any two from: Potassium: • more vigorous/move around faster/reacts faster/fizzes more/explodes • flame (IGNORE colour)/catches fire • forms a ball/bead/melts	forms an alkali/forms a hydroxide react vigorously exothermic/gives out heat reverse arguments for lithium comparison between the two, eg only potassium catches fire, they react at different rates		2 2
8	(e) (i)	$4Li + O_2 \rightarrow 2Li_2O$ **IGNORE** state symbols **M1** formulae **M2** balancing **M2** dep on **M1**	multiples and halves		2
	(ii)	2 (1) (1)	multiples and halves		1
				Total	**14**

Question number	Answer	Accept	Reject	Marks
9 (a) (i)	**M1** & **M2**– all points correctly plotted to nearest gridline deduct 1 mark for each incorrectly plotted point **M3** <u>smooth</u> curve of best fit drawn  			2 1
(ii)	value from candidate's graph to nearest gridline Penalise incorrect units			1
(iii)	as temperature <u>increases</u>, time (taken) <u>decreases</u> IGNORE references to rate and inverse proportionality	reverse argument negative correlation		1

Question number	Answer	Accept	Reject	Marks
9 (b)	**M1** (average kinetic) energy of particles/ions increases **M2** more collisions/particles/ions have energy ≥ activation energy **M3** more (successful) collisions <u>per</u> <u>second</u> / more <u>frequent</u> (successful) collisions **IGNORE** references to chance of collisions Penalise reference to molecules once only	particles move faster sufficient energy to react	molecules/atoms (but once only)	1 1 1
(c)	(same) concentration (of each solution)	(same) volume (of each solution) (same) amount of (each) solution rate of mixing		1
			Total	**9**

<table>
<tr><th>Question number</th><th>Answer</th><th>Accept</th><th>Reject</th><th>Marks</th></tr>
<tr><td>10 (a)</td><td>
<table>
<tr><th>initial</th><th>final</th><th>changes</th></tr>
<tr><td>16</td><td>17</td><td>(+)1</td></tr>
<tr><td>16</td><td>19</td><td>(+)3</td></tr>
<tr><td>16</td><td>21</td><td>(+)5</td></tr>
</table>

M1 & M2 all 6 temperature readings correct
deduct one mark for each incorrect value

M3 all 3 temperature changes correct

Mark M3 csq on temperature readings</td><td></td><td></td><td>2

1</td></tr>
<tr><td>(b)</td><td>M1 (the smaller the chips the) larger the (total) surface area

M2 more (thermal) energy (is transferred to the water)</td><td>heat for thermal energy
faster reaction
reverse argument for experiment 1</td><td></td><td>1

1</td></tr>
<tr><td>(c)</td><td>M1 (it would be) lower

M2 larger volume of liquid/more liquid <u>to heat</u>
<u>up</u> (with same amount of thermal energy transferred)

M2 dep on M1</td><td>water or acid in place of liquid</td><td></td><td>1

1</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>7</td></tr>
</table>

Question number	Answer	Accept	Reject	Marks
11 (a)	oxidised AND gain of oxygen IGNORE reference to loss of electrons	increase in oxidation number	gain of electrons	1
(b)	**M1** it/magnesium is more reactive than titanium **M2** it/magnesium has displaced titanium **M2** dep on **M1**	reverse argument replaced		1 1
(c)	it/magnesium chloride has a different/lower boiling point **IGNORE** references to melting point	more volatile reverse argument		1
(d)	**M1** (aircraft engines) – high strength-to-weight ratio **M2** (hip replacements) – non-toxic **M3** (propellers) – corrosion resistant **NO USE CAN BE GIVEN TWICE**	high m.pt / corrosion resistant high strength-to-weight ratio / corrosion resistant	not corrosive not corrosive	1 1 1
			Total	**7**

Question number	Answer	Accept	Reject	Marks
12 (a) (i)	**M1** $\frac{0.096}{24}$ **M2** 0.004(0)			1 1
(ii)	**M1** $\frac{25(.0)\times 0.4(00)}{1000}$ **M2** 0.01(00)	an answer of 10(.0) for 1 mark (i.e. failing to divide by 1000)		
(b)	**M1** 0.004 mol of Mg react with 0.008 mol of HCl **OR** 0.01 is greater than 0.008 / M2 from (a)(ii) is greater than 2 x **M2** from (a)(i) **M2** HCl is in excess **M2** dep on **M1** Mark csq on answers in (a)(i) and (a)(ii)	Mg and HCl react in a 1:2 ratio (by moles)		1 1
			Total	**6**

Question number	Answer	Accept	Reject	Marks
13 (a)	**M1** air **M2** natural gas / water/ hydrocarbons	atmosphere steam methane		1 1
(b)	**M1** (temperature) 400 to 500 °C **M2** (pressure) 150 to 250 atmospheres Units required, but allow one mark for both numbers correct with units missing **M3** (catalyst) iron / Fe **IGNORE** references to promoters such as iron oxide	623 to 823 K atm / bar		1 1 1
(c)	nitric acid / nitric(V) acid		all other oxidation states	1
(d)	**M1** $n(NH_3) = \frac{25(.0) \times 0.3(00)}{1000}$ / 7.5 x 10^{-3} (mol) **M2** $n(HNO_3) = \frac{25(.0) \times 0.3(00)}{1000}$ / 7.5 x 10^{-3} (mol) **M3** *conc.*(HNO_3) = 0.5(00) (mol/dm^3) OR $\frac{M2 \times 1000}{18}$ correctly evaluated Mark csq throughout correct answer with no working scores 3	other suitable methods, e.g. use of $V_1M_1 = V_2M_2$		1 1 1
			Total	**9**

Question number	Answer	Accept	Reject	Marks
14 (a)	**Any two from:** **M1** both forward and backwards reactions are occurring **M2** amounts/concentrations of reactants and products stay the same/pressure (of gas mixture) stays the same **M3** rate of forward reaction = rate of backwards reaction	masses for amounts	are the same	2
(b) (i)	**M1** increase **M2** (forward) reaction is exothermic/gives out heat **M2** dep on **M1** **IGNORE** references to le Chatelier's principle and to reaction tries to decrease the temperature/equilibrium shifts to right	reverse reaction is endothermic	equilibrium shifts to left	1 1
(b) (ii)	**M1** increase **M2** fewer moles/molecules (of gas) on right (hand side) **M2** dep on **M1** **IGNORE** references to le Chatelier's principle and to reaction tries to decrease the pressure/equilibrium shifts to right	more molecules on left (hand side)	equilibrium shifts to left	1 1

(c)	(i)	$2CH_3OH + O_2 \rightarrow 2H_2CO + 2H_2O$ **M1** formulae **M2** balancing **M2** dep on **M1** **IGNORE** catalyst if on <u>both</u> sides or above arrow **IGNORE** state symbols	multiples and halves		2
	(ii)	**M1** – a substance that increases the rate of a reaction **IGNORE** alters the rate and any reference to enzymes **M2** and is chemically unchanged (at the end of the reaction) **IGNORE** references to takes no part in the reaction	mass does not change without being used up		1 1
	(iii)	**M1** provides an alternative reaction path(way)/route/mechanism **M2** (alternative path has a) lower activation energy [Activation energy can be described, e.g. the minimum energy needed (by colliding particles) for reaction to occur] **MAX 1** if any mention of particles gaining energy	**M1** molecules adsorb on/stick to the catalyst **M2** weakens the bonds in the reactant molecules		1 1
(d)		$2CH_3OH + 3O_2 \rightarrow 2CO_2 + 4H_2O$ **M1** all formulae correct **M2** balanced **M2** dep on **M1** **IGNORE** state symbols	multiples and halves correct equation for methanal for one mark		2
				Total	**14**

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