

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

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. 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. Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. 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

January 2014

Publications Code UG037642

All the material in this publication is copyright

© Pearson Education Ltd 2014

General Marking Guidance

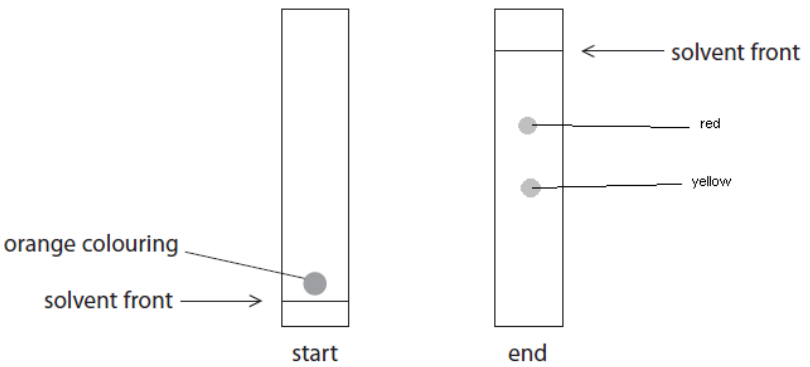
- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should 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 Y condensing Z freezing			1 1 1
(b)	C The particles move freely.			1
(c) (i)	thermometer			1
(ii)	it/water boils at 100°C OR it/water boils below the melting point of (solid) Q / 140°C / boils before Q melts IGNORE evaporates	water does not get hotter than 100°C reverse argument		1
(iii)	to keep the liquid at an even/equal temperature (throughout) 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	OWTTE	words that imply constant temperature, eg steady	1
			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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • sulfur dioxide • nitrogen monoxide • nitrogen dioxide • dinitrogen tetr(a)oxide • oxide(s) of nitrogen <p>If both a name and a formula are given, IGNORE the formula</p> <p>IGNORE carbon dioxide</p>	nitrogen oxide a correct formula	any other gas	1

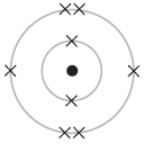
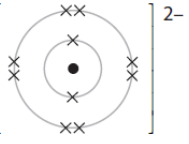
(d)	(i)	iron + oxygen (+ water) → (hydrated) iron (III) oxide M1 lhs M2 rhs	ferric oxide/iron oxide correct chemical equation M1 all formulae correct M2 balanced	any other oxidation state	2
	(ii)	M1 volume of oxygen = $80 - 63 / 17$ (cm ³) M2 percentage = $(\frac{17}{80} \times 100) / 21$ OR $\frac{M1}{80} \times 100$ correctly evaluated 21 with no working scores 1 78.75/78.8/78.7 with no working scores 1 $\frac{63}{80} \times 100 = 79$ scores 1 79 with no working scores 0	21.25 / 21.3/21.2		1 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)	<p>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</p>			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)	<p>M1 2 spots/dots/circles drawn at <u>different</u> heights above the original orange spot <u>and below</u> the solvent front</p> <p>M2 one spot labelled red AND one spot labelled yellow</p> <p>i.e.</p>  <p>The diagram shows two vertical rectangular plates representing chromatography paper. The left plate is labeled 'start' and has a horizontal line at the bottom labeled 'solvent front' with an arrow pointing to it. A grey dot labeled 'orange colouring' is positioned on the line. The right plate is labeled 'end' and has a horizontal line higher up labeled 'solvent front' with an arrow pointing to it. Two grey dots are positioned below the solvent front line: the upper one is labeled 'red' and the lower one is labeled 'yellow'.</p>	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

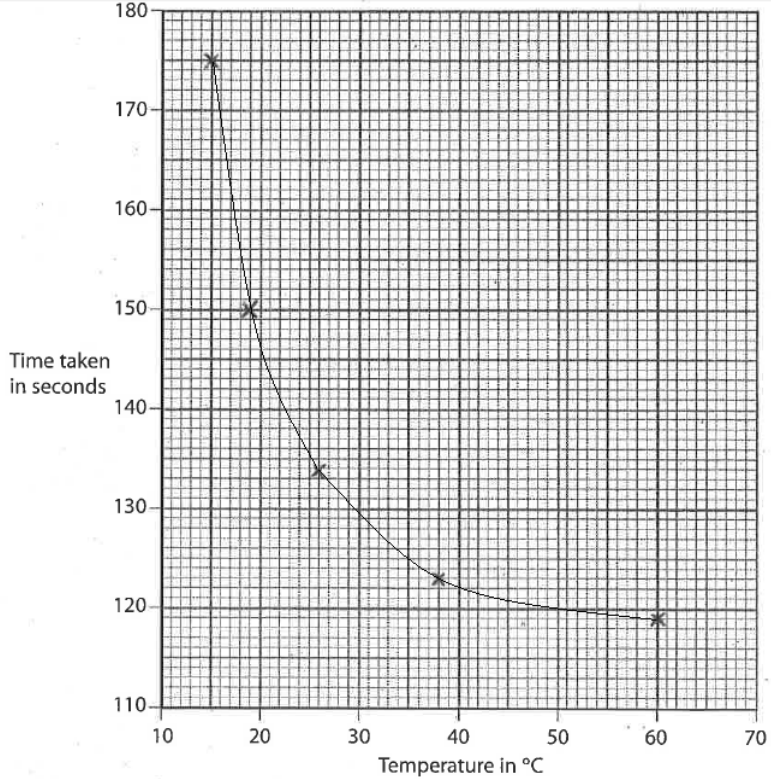
Question number	Answer	Accept	Reject	Marks
6 (a)	<p>M1 C₆H₁₄</p> <p>M2 58</p> <p>M3 any value in the range 25 to 45</p>			1 1 1
(b)	boiling point/it <u>increases</u> as <i>M_r</i> <u>increases</u>	reverse argument positive correlation as one increases the other increases	directly proportional	1
(c)	<p>different <u>general</u> formulae /</p> <p>OR</p> <p>(general) formula of ethene is <u>not</u> C_nH_{2n+2} / (general) formula of ethane is <u>not</u> C_nH_{2n}</p> <p>OR</p> <p>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</p>	same number of carbon atoms but different number of hydrogen atoms	just different number of hydrogen atoms	1
(d) (i)	<p>M1</p> <pre> H H H H H - C - C - C - C - H H H H H </pre> <p>M2</p> <pre> H H H H - C - C - C - H H C H H </pre> <p>penalise one missing H or one missing bond once only accept answers in either order</p>			1 1
(ii)	(structural) isomer(s)	isomerism		1


6	(e)	(i)	$\text{C}_2\text{H}_6 + \text{Br}_2 \rightarrow \text{C}_2\text{H}_5\text{Br} + \text{HBr}$ M1 – $\text{C}_2\text{H}_5\text{Br}$ 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)	 <p>D</p>			1
(c)	 <p>A</p>			1
(d)	<p>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</p> <p>M2 (strong) attraction between (positive <u>AND</u> negative/oppositely charged) ions/Mg^{2+} <u>AND</u> O^{2-} (ions)</p> <p>M3 many ions (present in lattice)/giant structure/giant lattice</p> <p>M4 large amount of energy required (to separate the ions/overcome the attraction between the ions)</p> <p>If mention of covalent bonds/metallic bonds/intermolecular forces only M4 can be awarded</p>	<p>(strong) ionic bonding/(strong) ionic bonds</p> <p>break the ionic bonding/bonds</p>		4
7 (e)	<p>M1 (name) magnesium chloride</p> <p>M2 (formula) $MgCl_2$</p> <p>Penalise inappropriate use of upper or lower case letters or numbers in the wrong place</p>	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	electronic structure / arrangement of electrons		1
	M2 same number of electrons in outer shell / one electron in outer shell			1
	OR the number of electrons in the outer shell determines the chemical properties			
(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 capital letters OH ⁻ for hydroxide ions pH is greater than 7	glowing spill just 'squeaky pop test'	1
	(ii) s l aq g			1
	(iii) M1 turns blue IGNORE purple			1
	M2 alkaline solution formed/alkali formed/hydroxide ions <u>ions</u> formed/LiOH is an alkali/LiOH forms hydroxide ions <u>ions</u> IGNORE references to lithium hydroxide is a metal hydroxide M2 dep on M1 correct or missing			1

(d)	Similarities - any two from:	forms an alkali/forms a hydroxide react vigorously exothermic/gives out heat		2	
	<ul style="list-style-type: none"> floats moves around fizzes/effervesces/bubbles/produces gas/produces hydrogen disappears/dissolves forms a solution Differences – any two from: Potassium: <ul style="list-style-type: none"> more vigorous/move around faster/reacts faster/fizzes more/explodes flame (IGNORE colour)/catches fire forms a ball/bead/melts 			reverse arguments for lithium comparison between the two, eg only potassium catches fire, they react at different rates	2
8	(e) (i)	$4\text{Li} + \text{O}_2 \rightarrow 2\text{Li}_2\text{O}$ 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)	<p>M1 & M2– all points correctly plotted to nearest gridline deduct 1 mark for each incorrectly plotted point</p> <p>M3 <u>smooth</u> curve of best fit drawn</p>  <p>value from candidate's graph to nearest gridline</p>			2 1
(ii)	<p>Penalise incorrect units</p>			1
(iii)	<p>as temperature <u>increases</u>, time (taken) <u>decreases</u></p> <p>IGNORE references to rate and inverse proportionality</p>	<p>reverse argument</p> <p>negative correlation</p>		1

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

Question number	Answer	Accept	Reject	Marks												
10 (a)	<table border="1"> <thead> <tr> <th>initial</th> <th>final</th> <th>changes</th> </tr> </thead> <tbody> <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> </tbody> </table> <p>M1 & M2 all 6 temperature readings correct deduct one mark for each incorrect value</p> <p>M3 all 3 temperature changes correct</p> <p>Mark M3 csq on temperature readings</p>	initial	final	changes	16	17	(+)1	16	19	(+)3	16	21	(+)5			2 1
initial	final	changes														
16	17	(+)1														
16	19	(+)3														
16	21	(+)5														
(b)	<p>M1 (the smaller the chips the) larger the (total) surface area</p> <p>M2 more (thermal) energy (is transferred to the water)</p>	<p>heat for thermal energy</p> <p>faster reaction</p> <p>reverse argument for experiment 1</p>		1 1												
(c)	<p>M1 (it would be) lower</p> <p>M2 larger volume of liquid/more liquid <u>to heat</u> <u>up</u> (with same amount of thermal energy transferred)</p> <p>M2 dep on M1</p>	<p>water or acid in place of liquid</p>		1 1												
			Total	7												

Question number	Answer	Accept	Reject	Marks
11 (a)	oxidised <u>AND</u> 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 $\frac{0.008}{24}$ M2 0.004(0)			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)		1
(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
			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 $n(\text{NH}_3) = \frac{25(0) \times 0.3(00)}{1000} / 7.5 \times 10^{-3} \text{ (mol)}$ M2 $n(\text{HNO}_3) = \frac{25(0) \times 0.3(00)}{1000} / 7.5 \times 10^{-3} \text{ (mol)}$ M3 $\text{conc.}(\text{HNO}_3) = 0.5(00) \text{ (mol/dm}^3\text{)}$ OR $\frac{M_2 \times 1000}{18}$ 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)	<p>Any two from:</p> <p>M1 both forward and backwards reactions are occurring</p> <p>M2 amounts/concentrations of reactants and products stay the same/pressure (of gas mixture) stays the same</p> <p>M3 rate of forward reaction = rate of backwards reaction</p>	masses for amounts	are the same	2
(b) (i)	<p>M1 increase</p> <p>M2 (forward) reaction is exothermic/gives out heat</p> <p>M2 dep on M1</p> <p>IGNORE references to le Chatelier's principle and to reaction tries to decrease the temperature/equilibrium shifts to right</p>	<u>reverse</u> reaction is endothermic	equilibrium shifts to left	1 1
(b) (ii)	<p>M1 increase</p> <p>M2 fewer moles/molecules (of gas) on right (hand side)</p> <p>M2 dep on M1</p> <p>IGNORE references to le Chatelier's principle and to reaction tries to decrease the pressure/equilibrium shifts to right</p>	more molecules on left (hand side)	equilibrium shifts to left	1 1

(c)	(i)	$2\text{CH}_3\text{OH} + \text{O}_2 \rightarrow 2\text{H}_2\text{CO} + 2\text{H}_2\text{O}$ 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
	(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
(d)	$2\text{CH}_3\text{OH} + 3\text{O}_2 \rightarrow 2\text{CO}_2 + 4\text{H}_2\text{O}$ 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

