

Mark Scheme (Results)

June 2014

Pearson Edexcel Certificate
Chemistry (KCH0) Paper 2C

Pearson Edexcel International GCSE
Chemistry (4CH0) Paper 2C

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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	Notes	Marks
1	a	i	B (2)		1
	b		FR AND FG FR and FG/they/colourings/dyes/spots/OWTTE AND line up/match/correspond with/travel same distance(s) as / have same R_f values as AND SR and SG/safe colourings/red and green colourings	Choice can be indicated by ticks or other marks or Yes M2 DEP on M1 correct or missing Ignore references to FB unless incorrect Ignore references to FR and FG containing/being the same as SR and SG	1 1

(Total for Question 1 = 3 marks)

Question number		Answer	Notes	Marks
2	a	<u>fractional</u> distillation / fractionation	Ignore just distillation Reject simple distillation	1
	b	(they have) different boiling points/boiling temperatures / boil at different temperatures OR ethanol has a lower boiling point (than water) /water has a higher boiling point (than ethanol))	Ignore references to melting point Ignore references to condensing Accept one boils at 78(°C), the other at 100(°C) Accept ethanol boils/evaporates first Ignore boils/evaporates faster	1
	c	to keep the jacket full of water /to make sure there is no air in the jacket /to surround the whole tube OR (for B) not enough water in the condenser / water not in contact with tube for long enough /water runs straight out	Accept tube/condenser in place of jacket Accept reverse arguments relating to B Ignore references to rate of cooling or condensing Ignore so that more ethanol /vapour/gas condenses / to make sure all the ethanol/vapour/gas condenses Ignore references to glass breaking	1

Question number		Answer	Notes	Marks
2	d	(ethanol/it) has a lower boiling point/is more volatile (than water) OR boils/evaporates first/before water	Accept weaker forces of attraction between ethanol molecules Accept reverse arguments for water Accept boiling point (of ethanol) reached first Ignore incorrect difference eg 12°C lower Ignore boils/evaporates faster Ignore references to rate of evaporation /boiling/condensation Ignore ethanol condenses first	1

(Total for Question 2 = 4 marks)

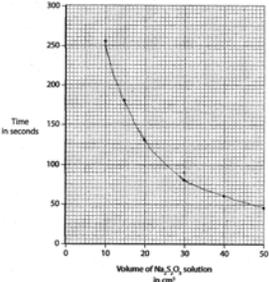
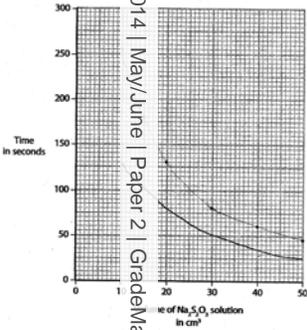
Question number			Answer	Notes	Marks
3	a	i	period	Ignore number of period	1
		ii	Any two of sodium / magnesium / aluminium	Ignore symbols Na, Mg, Al	1
		iii	Ar / argon (it does) not easily gain/lose electrons OR has 8 electrons in outer shell	If name and symbol both given, then both must be correct Accept (it has) a full outer shell Ignore 2.8.8 Ignore inert/noble gas Ignore references to Group number Ignore stable M2 DEP on M1	2
	b		one electron/same number of electrons AND reference to outer/valence (shell/energy level/orbitals)	Reject incorrect number of electrons Ignore similar electronic configurations Ignore actual electronic configurations	1
	c	i	C / carbon		1
		ii	S / sulfur		1
	d		8 for both protons AND electrons	Accept words	1
			10 neutrons	Accept words	1

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(Total for Question 3 = 9 marks)

Question number		Answer	Notes	Marks
4	a	sulfur/precipitate forms	Accept usual precipitate alternatives Ignore precipitate colour Accept cloudy / opaque Reject wrongly identified <u>precipitate</u> (eg sodium chloride)	1
	b	to keep the depth/height/shalowness of liquid (in the conical flask) the same / OWTTE OR the same mass of sulfur (needed to obscure the cross)	Accept reverse argument Reject to keep the concentration the same	1
	c	reaction would start before the correct depth /concentration of liquid was obtained OR the reaction starts when the acid is added / straight away/ before the water is added	Ignore references to keeping the total volume constant Ignore references to fair test / accuracy / safety	1

Question number	Answer	Notes	Marks	
4	d	<p>fume cupboard / well-ventilated room /open windows / extractor fan OR wear eye protection / safety goggles / OWTTE OR (gas) mask / respirator</p> <p>(SO₂/it is) poisonous/toxic OR reference to specific harmful effect on humans (eg affects breathing/respiratory irritant /eye irritant/triggers asthma attack/makes bronchitis or emphysema worse) OR to prevent gas reaching eyes/lungs/OWTTE</p>	<p>Ignore references to pollution / acid rain / greenhouse effect Ignore just harmful</p> <p>Mark independently To score M1 and M2, explanation must match precaution:</p> <ul style="list-style-type: none"> • fume cupboard etc can link with all explanations • eye protection etc. can link with all explanations except those involving breathing etc. • mask etc. can link with all explanations except those involving eyes etc. 	<p>1</p> <p>1</p>

Question number			Answer	Notes	Marks
4	e	i	all points correctly plotted to nearest gridline 	Deduct 1 mark for each incorrect plot	2
		ii	suitable curve of best fit based on plotted points curve completely below original curve starts at $V = 10 \text{ cm}^3$, finishes at $\text{vol} = 50 \text{ cm}^3$ 	Do not penalise continuation of line above 255 s unless incorrect (eg straight line to 300 s) Do not award mark if curve starts from (10,255) DEP on point plotted for experiment 1	1 1 1

(Total for Question 4 = 10 marks)

Question number		Answer	Notes	Marks
5	a	decomposition / breakdown / breakup / splitting / chemical change by electricity / (electric) current / (flow of) electrons	Ignore specific examples that do not include key words (eg obtaining aluminium from its ore) Ignore separation / movement of ions Mark independently	2
	b	A = chlorine / Cl ₂ B = hydrogen / H ₂ C = sodium hydroxide / NaOH	Ignore Cl Ignore H Ignore references to sodium chloride If both name and formula given, both must be correct, but ignore Cl and H Award 1 mark for chlorine and hydrogen the wrong way round	3

Question number			Answer	Notes	Marks
5	c	i	so that ions are mobile/can flow/free to move (in liquid) OR ions not mobile / cannot flow/ not free to move in solid	Accept Na ⁺ / Cl ⁻ in place of ions Ignore references to charged species and particles Reject references to moving electrons Reject no ions in solid Reference to solid can be implied (eg if not molten...)	1
		ii	$2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^{(-)}$	M1 for Cl ⁻ on left and Cl ₂ on right M2 for balancing, DEP on M1 correct Accept - 2e ⁽⁻⁾ on LHS If neither M1 nor M2 awarded, then award 1 mark for Cl ⁻ → Cl + e ⁽⁻⁾ or 2Cl ⁻ → 2Cl + 2e ⁽⁻⁾	2

(Total for Question 5 = 8 marks)

Question number		Answer	Notes	Marks
6	a	brown precipitate	Accept usual alternatives for precipitate Ignore qualifiers such as dark / light Ignore red(dish) / orange / rust(y) Reject other colours Ignore all names and formulae	1
	b	i	ammonium / NH_4^+ gas given off is ammonia / NH_3	1 1
		ii	sulfate / SO_4^{2-}	1
	c	Zn / zinc (it) loses Fe^{3+} / zinc is oxidised / zinc increases its oxidation number	Accept Fe^{3+} gains electron(s)/is reduced/oxidation number decreases Ignore Fe^{3+} converted to Fe^{2+} / Zn converted to Zn^{2+} Reject iron/Fe gains electrons M2 DEP on M1	1 1

(Total for Question 6 = 6 marks)

Question number			Answer	Notes	Marks
7	a	i	Any two of <ul style="list-style-type: none"> (same) general formula same/similar <u>chemical</u> properties /behaviour/characteristics OR same/similar reactions <ul style="list-style-type: none"> gradation/gradual change/trend /increase/decrease in physical properties same functional group (successive) members differ by CH_2 	Apply list principle Ignore specific general formula Ignore specific chemical properties, eg combustion Ignore trend etc. in chemical properties Accept reference to specific physical property, eg boiling point Reject same/similar physical properties Ignore differ by $M_r = 14$	2
		ii	$ \begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{H}-\text{C}-\text{C}-\text{H} \\ \quad \\ \text{H} \quad \text{H} \end{array} $	All atoms and bonds must be shown OH group can be in any position Ignore bond angles	1

Question number		Answer	Notes	Marks
7	b	<p>batch process slower /continuous process faster batch process less pure / continuous process purer</p> <p>batch process uses renewable/sustainable/non-finite resources resources that do not run out AND continuous process uses finite resources</p> <p>OR unambiguous reference to one process (eg only the batch process uses renewable resources)</p>	<p>Accept batch process slow AND continuous process fast Accept batch process gives impure product AND continuous process gives pure product Ignore references to yield Accept OWTTE, eg sugar used in batch process can be grown again, crude oil is not being replaced</p> <p>Ignore uses plant material for renewable and uses crude oil for finite Accept references to fermentation/sugars in place of batch, and hydration/ethene in place of continuous</p>	<p>1</p> <p>1</p> <p>1</p>

Question number			Answer	Notes	Marks
7	c	i	$\frac{3600 \times 1000}{180}$ $= 20\,000 \text{ (mol)}$	CQ on M1 20 000 with or without working scores 2 marks 20 mol scores 1/2	1
		ii	(c)(i) $\times 2$ / 40 000 (mol)		1
		iii	(c)(ii) $\times 24$ $= 960\,000 \text{ dm}^3$		1
				Correct or consequential answer with or without working scores 2 marks	1

(Total for Question 7 = 11 marks)

Question number			Answer	Notes	Marks
8	a	i	high / higher (temperature) because (forward) reaction is endothermic /absorbs heat	Accept reverse reaction is exothermic Accept reaction shifts in endothermic direction /favours the endothermic reaction (more) Ignore references to Le Chatelier's principle	1
		ii	low / lower (pressure) because more moles/molecules (of gas) on RHS / products side / hydrogen side	Accept fewer moles/molecules on LHS Accept 2 mol on LHS and 4 mol on RHS Accept particles in place of molecules Accept shift to side with more moles Ignore references to Le Chatelier's principle	1
	b		provides an alternative route /pathway/ mechanism with lower activation energy OR (gas) molecules adsorb/stick to surface of catalyst (covalent) bonds in molecules weakened	Ignore just a route/path If no reference to <u>activation</u> energy, then accept references to energy if qualified by idea of being needed to start the reaction MAX 1 if any reference to particles gaining energy or moving more quickly	2

Question number			Answer	Notes	Marks
8	c	i	$\text{CO} + \text{H}_2\text{O} \rightleftharpoons \text{CO}_2 + \text{H}_2$	M1 for all formulae correct M2 for balancing AND reversible arrow Ignore state symbols M2 DEP on M1	2
		ii	(carbon/it) gains/reacts with oxygen / oxygen is added	Accept oxygen atom/molecule Accept increase in oxidation number Accept actual oxidation numbers if correct (+2 to +4) Reject oxide ion Ignore references to gain or loss of electrons	1
		iii	$\text{K}_2\text{CO}_3 + \text{CO}_2 + \text{H}_2\text{O} \rightarrow 2\text{KHCO}_3$	M1 for all formulae correct and on the correct sides M2 for balancing M2 DEP on M1	2

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(Total for Question 8 = 9 marks)

