



Mark Scheme (Results)

Summer 2016

Pearson Edexcel International GCSE
in Chemistry (4CH0) Paper 2CR

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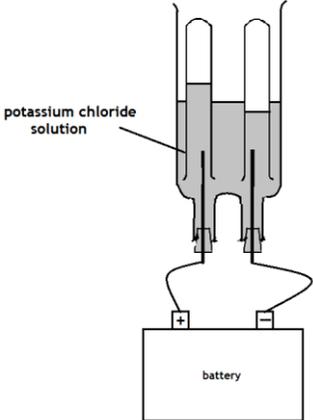
General Marking Guidance

- 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	A (the crystal dissolves)		1
b	A (it is all blue)		1
c i	4		1
ii	21		1

Question number	Answer	Notes	Marks						
2 a	<p>M1 oxygen / air</p> <p>M2 water (vapour) / moisture</p>	<p>ACCEPT O₂ but not O</p> <p>ACCEPT H₂O</p> <p>IGNORE steam</p>	2						
b	(hydrated) iron(III) oxide	<p>ACCEPT iron oxide / ferric oxide</p> <p>REJECT ferrous oxide and iron with other oxidation numbers</p> <p>IGNORE iron trioxide</p> <p>ACCEPT Fe₂O₃(.xH₂O)</p> <p>IGNORE all other formulae</p> <p>If both name and formula given mark name only</p>	1						
c	<table border="1" data-bbox="338 847 1120 1106"> <tbody> <tr> <td data-bbox="338 847 728 956">M1 (galvanising)</td> <td data-bbox="728 847 1120 956">bucket / car body / railway bridge</td> </tr> <tr> <td data-bbox="338 956 728 1031">M2 (oiling)</td> <td data-bbox="728 956 1120 1031">bicycle chain / car engine</td> </tr> <tr> <td data-bbox="338 1031 728 1106">M3 (painting)</td> <td data-bbox="728 1031 1120 1106">car body / railway bridge</td> </tr> </tbody> </table>	M1 (galvanising)	bucket / car body / railway bridge	M2 (oiling)	bicycle chain / car engine	M3 (painting)	car body / railway bridge	<p>DO NOT AWARD M3 for car body/railway bridge if already scored for M1</p>	3
M1 (galvanising)	bucket / car body / railway bridge								
M2 (oiling)	bicycle chain / car engine								
M3 (painting)	car body / railway bridge								
d	<p>M1 zinc corrodes/oxidises/reacts in preference to iron</p> <p>M2 (because) zinc is more reactive than iron / zinc (atoms) lose electrons more readily (than do iron atoms)</p>	<p>REJECT zinc rusts</p> <p>IGNORE reference to sacrificial protection</p> <p>ACCEPT for M1 zinc atoms react with iron(II) ions</p> <p>ACCEPT for M2 iron(II) ions are converted to iron atoms</p>	2						

Question number	Answer	Notes	Marks
3 a	C (nitrogen)		1
b	A (argon)		1
c	M1 (formula) CuO M2 (colour) black	ACCEPT correct formula as a product of an equation. The equation need not be balanced IGNORE names IGNORE brown REJECT all other colours	2
d i	C (dilute hydrochloric acid)		1
ii	A (calcium carbonate)		1
iii	in a (gas) syringe / downward delivery in air	ALLOW downward delivery	1
e i	$\text{CO}_2(\mathbf{g}) + \text{Ca}(\text{OH})_2(\mathbf{aq}) \rightarrow \text{CaCO}_3(\mathbf{s}) + \text{H}_2\text{O}(\text{l})$	ACCEPT upper case letters IGNORE words	1
e ii	white precipitate forms / liquid goes milky/cloudy	ACCEPT usual alternatives for precipitate	1

Question number	Answer	Notes	Marks						
4 a		<p>M1 both bungs inserted AND electrodes connected to battery</p> <p>M2 both tubes inverted over electrodes</p> <p>M3 solution placed in the voltameter and labelled as potassium chloride / KCl(aq)</p> <p>For M3, ignore all three liquid levels, except that the level in the voltameter must be above the bottoms of both tubes if present</p>	3						
b	<table border="1" data-bbox="338 852 1003 1062"> <thead> <tr> <th data-bbox="338 852 510 919">Polarity</th> <th data-bbox="510 852 1003 919">Equation</th> </tr> </thead> <tbody> <tr> <td data-bbox="338 919 510 986">-(ve)</td> <td data-bbox="510 919 1003 986">$(2\text{H}_2\text{O} + 2\text{e}^- \rightarrow \text{H}_2 + 2\text{OH}^-)$</td> </tr> <tr> <td data-bbox="338 986 510 1062">+(ve)</td> <td data-bbox="510 986 1003 1062">$2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$</td> </tr> </tbody> </table>	Polarity	Equation	-(ve)	$(2\text{H}_2\text{O} + 2\text{e}^- \rightarrow \text{H}_2 + 2\text{OH}^-)$	+(ve)	$2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$	<p>M1 for $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$</p> <p>ACCEPT $2\text{Cl}^- - 2\text{e}^- \rightarrow \text{Cl}_2$</p> <p>M2 for -(ve) in top row AND +(ve) in bottom row</p> <p>ACCEPT negative and positive</p> <p>IGNORE cathode and anode</p>	2
Polarity	Equation								
-(ve)	$(2\text{H}_2\text{O} + 2\text{e}^- \rightarrow \text{H}_2 + 2\text{OH}^-)$								
+(ve)	$2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$								
c	<p>burns with a pop / squeak</p> <p>OR</p> <p>use burning/lit spill / use flame to see if pop/squeak</p>	<p>Must be reference to test and result</p> <p>Reference to spill/match with no indication of flame is not enough</p> <p>ACCEPT splint for spill</p> <p>REJECT reference to glowing spill/splint</p> <p>Ignore flame extinguished</p> <p>'Squeaky pop test' alone is not sufficient</p>	1						

Question number	Answer	Notes	Marks												
5 a i	<table border="1" data-bbox="360 341 1115 632"> <thead> <tr> <th data-bbox="360 341 548 493">Atomic number</th> <th data-bbox="548 341 736 493">Mass number</th> <th data-bbox="736 341 925 493">Number of protons</th> <th data-bbox="925 341 1115 493">Number of neutrons</th> </tr> </thead> <tbody> <tr> <td data-bbox="360 493 548 560"></td> <td data-bbox="548 493 736 560"></td> <td data-bbox="736 493 925 560">19</td> <td data-bbox="925 493 1115 560">20</td> </tr> <tr> <td data-bbox="360 560 548 632">19</td> <td data-bbox="548 560 736 632">41</td> <td data-bbox="736 560 925 632"></td> <td data-bbox="925 560 1115 632"></td> </tr> </tbody> </table>	Atomic number	Mass number	Number of protons	Number of neutrons			19	20	19	41			<p>M1 for 19 protons in top row AND atomic number of 19</p> <p>M2 for 20 neutrons in top row</p> <p>M3 for mass number of 41</p> <p>ACCEPT $\frac{(6 \times 7.4) + (7 \times 92.6)}{100}$</p> <p>Answer must be to 1 dp Correct final answer without working scores 2 marks</p>	3
Atomic number	Mass number	Number of protons	Number of neutrons												
		19	20												
19	41														
ii	<p>M1 $(6 \times 0.074) + (7 \times 0.926)$</p> <p>M2 = 6.9</p>		2												
b	<p>any two from</p> <ul data-bbox="371 959 1003 1385" style="list-style-type: none"> • effervescence/fizzing/bubbles • potassium moves/darts/floats • potassium leaves white trail • potassium forms into a ball • potassium becomes smaller/disappears • (lilac) flame 	<p>ACCEPT (hydrogen) gas given off/evolved/formed/produced</p> <p>IGNORE name of gas</p> <p>ACCEPT melts</p> <p>ACCEPT dissolves</p> <p>IGNORE colour of flame / explodes</p>	2												

Question number	Answer	Notes	Marks
5 c i	pink	ALLOW red IGNORE purple	1
ii	$\text{OH}^- / \text{HO}^-$		1
d	<p>M1 potassium loses its outer/valence electron more easily/readily</p> <p>M2 because it is further from (the attraction of) nucleus (and therefore less strongly attracted to the nucleus)</p>	<p>IGNORE references to more shells / larger atomic radius / more shielding / more screening</p> <p>ACCEPT reverse arguments as long as it is clear that lithium is being considered</p>	2

Question number	Answer	Notes	Marks
6 a	<p>M1 twice as much/more carbon dioxide removed (per mole reacted)</p> <p>M2 produces oxygen (for breathing)</p>	<p>ACCEPT reverse arguments for both M1 and M2 eg lithium hydroxide removes less CO₂ and does not produce oxygen scores 2</p> <p>IGNORE references to the need to remove water in reaction 1</p>	2
b i	<p>M1 $n(\text{CO}_2) = \frac{100}{44}$ OR 2.27(27....) (mol)</p> <p>M2 $n(\text{LiOH}) = \text{answer to M1} \times 2$ OR 4.54(54.....) (mol)</p> <p>M3 $m(\text{LiOH}) = (\text{answer to M3} \times 24) = 110$ (g)</p> <p>OR</p> <p>M1 48 (g) reacts with 44 (g)</p> <p>M2 x (g) reacts with 100 (g)</p> <p>M3 x = 110 (g)</p>	<p>ACCEPT any number of sig figs except one eg 109 / 109.1 / 109.09 / 109.0909.....</p> <p>Award 3 marks for correct final answer without working</p> <p>108.96 (from 2.27) scores 3 marks 110.4 (from 2.3) scores 3 marks</p>	3

Question number	Answer	Notes	Marks
6 b ii	<p>M1 $n(\text{Li}_2\text{O}_2) = \frac{100}{46} = 2.17(3913\dots)$ mol (= $n\text{CO}_2$)</p> <p>M2 volume of $\text{CO}_2 = \text{answer to M1} \times 24\,000$</p> <p>M3 = 52 000 (cm^3)</p>	<p>ACCEPT any number of sig figs except one eg 52 170, 52 174, 52 173.9, etc</p> <p>Award 3 marks for correct final answer without working</p> <p>52 080 (from 2.17) scores 3 marks 52 800/53 000 (from 2.2) scores 3 marks</p>	3

Question number	Answer	Notes	Marks						
7 a	<p>M1 (step 1) nitric acid</p> <p>M2 (step 2) magnesium carbonate is insoluble / magnesium carbonate does not form a solution</p> <p>M3 (step 3) boiling off all the water (will not produce a hydrated salt)</p>	<p>ACCEPT sulfuric acid should be used</p> <p>REJECT the use of reagents that would not work, eg magnesium chloride</p>	3						
7 b i	<table border="1" data-bbox="338 775 871 983"> <tbody> <tr> <td data-bbox="338 775 719 842">M1 (after)</td> <td data-bbox="719 775 871 842">23.80</td> </tr> <tr> <td data-bbox="338 842 719 909">M2 (before)</td> <td data-bbox="719 842 871 909">2.15</td> </tr> <tr> <td data-bbox="338 909 719 983">M3 (volume added)</td> <td data-bbox="719 909 871 983">21.65</td> </tr> </tbody> </table>	M1 (after)	23.80	M2 (before)	2.15	M3 (volume added)	21.65	<p>If both readings are correct but in the wrong order, award 1 mark for M1 and M2</p> <p>M3 CQ on the values given for M1 and M2</p> <p>Penalise missing trailing zeros once only</p>	3
M1 (after)	23.80								
M2 (before)	2.15								
M3 (volume added)	21.65								
b ii	<p>M1 (the calculated) volume will be higher</p> <p>M2 because it includes the air (contained in the tip of the burette)</p>	<p>M2 dep on M1</p>	2						

c	i	ticks in columns 2 and 4	1
	ii	<p>M1 $\frac{26.45 + 26.25}{2}$</p> <p>M2 26.35 (cm³)</p>	<p>CQ on any combination of ticked results</p> <p>If no results are ticked then M1 can only be awarded if the values from columns 2 and 4 are averaged</p> <p>If only one column ticked then no marks can be awarded in (c)(ii)</p> <p>CQ on results averaged Answers should be to 2dp, except trailing zero not needed</p> <p>Correct final answer without working scores 2</p>

Question number	Answer	Notes	Marks
7 d	<p>M1 heat/boil until crystals form in a sample of solution that has been removed (and cooled)</p> <p>M2 leave (the solution) to cool (so that crystals form)</p> <p>M3 filter (to obtain crystals)</p> <p>AND</p> <p>suitable method of drying crystals</p>	<p>ACCEPT heat/boil to produce a (hot) saturated/concentrated solution</p> <p>ACCEPT heat until crystals start/begin to form</p> <p>ALLOW (heat/boil to) evaporate some of the water</p> <p>ALLOW heat/boil to crystallisation point</p> <p>IGNORE references to filtering before heating</p> <p>M2 dep on M1</p> <p>ACCEPT decant/pour off the liquid/(excess)solution for filter</p> <p>eg place in (warm) oven / leave to dry (in warm place) / use filter paper / use kitchen towel</p> <p>REJECT any reference to heating directly with a flame, eg with a Bunsen</p> <p>IGNORE reference to washing crystals</p> <p>M3 dep on M1</p> <p>If M1 not scored then award 1 mark out of 3 for leaving the solution until the water evaporates fully</p>	3

