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Mark Scheme (Results)

Summer 2016

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

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Summer 2016
Publications Code 4CH0_2CR_1606_MS

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

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>2 a</td><td>M1 oxygen / air

M2 water (vapour) / moisture</td><td>ACCEPT O_2 but not O

ACCEPT H_2O
IGNORE steam</td><td>2</td></tr>
<tr><td>b</td><td>(hydrated) iron(III) oxide</td><td>ACCEPT iron oxide / ferric oxide
REJECT ferrous oxide and iron with other oxidation numbers
IGNORE iron trioxide

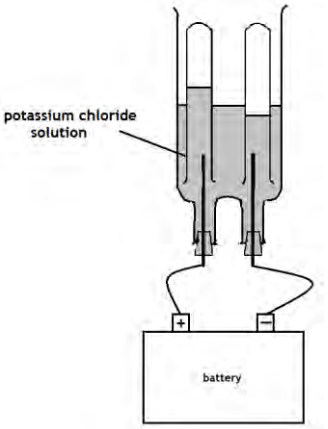
ACCEPT $Fe_2O_3(.xH_2O)$
IGNORE all other formulae

If both name and formula given mark name only</td><td>1</td></tr>
<tr><td>c</td><td><table><tr><td>M1 (galvanising)</td><td>bucket / car body / railway bridge</td></tr><tr><td>M2 (oiling)</td><td>bicycle chain / car engine</td></tr><tr><td>M3 (painting)</td><td>car body / railway bridge</td></tr></table></td><td>DO NOT AWARD M3 for car body/railway bridge if already scored for M1</td><td>3</td></tr>
<tr><td>d</td><td>M1 zinc corrodes/oxidises/reacts in preference to iron

M2 (because) zinc is more reactive than iron / zinc (atoms) lose electrons more readily (than do iron atoms)</td><td>REJECT zinc rusts
IGNORE reference to sacrificial protection
ACCEPT for M1 zinc atoms react with iron(II) ions

ACCEPT for M2 iron(II) ions are converted to iron atoms</td><td>2</td></tr>
</table>

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	CO_2(**g**) + $Ca(OH)_2$(**aq**) → $CaCO_3$(**s**) + H_2O(**l**)	**ACCEPT** upper case letters **IGNORE** words	1
e ii	white precipitate forms / liquid goes milky/cloudy	**ACCEPT** usual alternatives for precipitate	1

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>4 a</td><td> 
</td><td>M1 both bungs inserted AND electrodes connected to battery

M2 both tubes inverted over electrodes

M3 solution placed in the voltameter and labelled as potassium chloride / KCl(aq)

For M3, ignore all three liquid levels, except that the level in the voltameter must be above the bottoms of both tubes if present</td><td>3</td></tr>
<tr><td>b</td><td><table><tr><th>Polarity</th><th>Equation</th></tr><tr><td>−(ve)</td><td>($2H_2O + 2e^- \rightarrow H_2 + 2OH^-$)</td></tr><tr><td>+(ve)</td><td>$2Cl^- \rightarrow Cl_2 + 2e^{(-)}$</td></tr></table></td><td>M1 for $2Cl^- \rightarrow Cl_2 + 2e^{(-)}$
ACCEPT $2Cl^- - 2e^{(-)} \rightarrow Cl_2$

M2 for −(ve) in top row AND +(ve) in bottom row
ACCEPT negative and positive
IGNORE cathode and anode</td><td>2</td></tr>
<tr><td>c</td><td>burns with a pop / squeak

OR

use burning/lit spill / use flame to see if pop/squeak</td><td>Must be reference to test and result
Reference to spill/match with no indication of flame is not enough
ACCEPT splint for spill
REJECT reference to glowing spill/splint
Ignore flame extinguished
'Squeaky pop test' alone is not sufficient</td><td>1</td></tr>
</table>

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>5 a i</td><td>
<table>
<tr><th>Atomic number</th><th>Mass number</th><th>Number of protons</th><th>Number of neutrons</th></tr>
<tr><td></td><td></td><td>19</td><td>20</td></tr>
<tr><td>19</td><td>41</td><td></td><td></td></tr>
</table>
</td><td>M1 for 19 protons in top row AND atomic number of 19

M2 for 20 neutrons in top row

M3 for mass number of 41</td><td>3</td></tr>
<tr><td>ii</td><td>M1 (6 × 0.074) + (7 × 0.926)

M2 = 6.9</td><td>ACCEPT $\frac{(6 \times 7.4) + (7 \times 92.6)}{100}$

Answer must be to 1 dp
Correct final answer without working scores 2 marks</td><td>2</td></tr>
<tr><td>b</td><td>any two from
• effervescence/fizzing/bubbles
• potassium moves/darts/floats
• potassium leaves white trail
• potassium forms into a ball
• potassium becomes smaller/disappears
• (lilac) flame</td><td>ACCEPT (hydrogen) gas given off/evolved/formed/produced
IGNORE name of gas

ACCEPT melts

ACCEPT dissolves

IGNORE colour of flame / explodes</td><td>2</td></tr>
</table>

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

Question number	Answer	Notes	Marks
6 a	**M1** twice as much/more carbon dioxide removed (per mole reacted) **M2** produces oxygen (for breathing)	**ACCEPT** reverse arguments for both **M1** and **M2** eg lithium hydroxide removes less CO_2 and does not produce oxygen scores 2 **IGNORE** references to the need to remove water in reaction 1	2
b i	**M1** $n(CO_2) = \frac{100}{44}$ OR 2.27(27....) (mol) **M2** n(LiOH) = answer to **M1** x 2 OR 4.54(54.....) (mol) **M3** m(LiOH) = (answer to **M3** x 24) = 110 (g) **OR** **M1** 48 (g) reacts with 44 (g) **M2** x (g) reacts with 100 (g) **M3** x = 110 (g)	**ACCEPT** any number of sig figs except one eg 109 / 109.1 / 109.09 / 109.0909..... Award 3 marks for correct final answer without working 108.96 (from 2.27) scores 3 marks 110.4 (from 2.3) scores 3 marks	3

Question number	Answer	Notes	Marks
6 b ii	**M1** $n(Li_2O_2) = \frac{100}{46} = 2.17(3913.....)$ mol (= nCO_2) **M2** volume of CO_2 = answer to **M1** × 24 000 **M3** = 52 000 (cm^3)	**ACCEPT** any number of sig figs except one eg 52 170, 52 174, 52 173.9, etc Award 3 marks for correct final answer without working 52 080 (from 2.17) scores 3 marks 52 800/53 000 (from 2.2) scores 3 marks	3

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>7 a</td><td>M1 (step 1) nitric acid

M2 (step 2) magnesium carbonate is insoluble / magnesium carbonate does not form a solution

M3 (step 3) boiling off all the water (will not produce a hydrated salt)</td><td>ACCEPT sulfuric acid should be used

REJECT the use of reagents that would not work, eg magnesium chloride</td><td>3</td></tr>
<tr><td>7 b i</td><td><table><tr><td>M1 (after)</td><td>23.80</td></tr><tr><td>M2 (before)</td><td>2.15</td></tr><tr><td>M3 (volume added)</td><td>21.65</td></tr></table></td><td>If both readings are correct but in the wrong order, award 1 mark for M1 and M2

M3 CQ on the values given for M1 and M2

Penalise missing trailing zeros once only</td><td>3</td></tr>
<tr><td>b ii</td><td>M1 (the calculated) volume will be higher

M2 because it includes the air (contained in the tip of the burette)</td><td>M2 dep on M1</td><td>2</td></tr>
</table>

c i	ticks in columns 2 and 4		1
ii	**M1** $\frac{26.45 + 26.25}{2}$	CQ on any combination of ticked results If no results are ticked then **M1** can only be awarded if the values from columns 2 and 4 are averaged If only one column ticked then no marks can be awarded in (c)(ii)	2
	M2 26.35 (cm^3)	CQ on results averaged Answers should be to 2dp, except trailing zero not needed Correct final answer without working scores 2	

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

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