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## Mark Scheme (Results)

January 2018

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

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January 2018

Publications Code 4CH0\_2C\_1801\_MS

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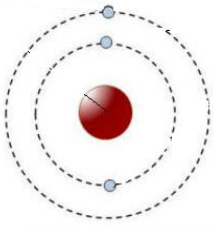
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## **General Marking Guidance**

- 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)	P beaker Q (filter) funnel R conical flask S pipette		4
(b)	D red		1
(c)	A blue		1

Total 6 marks

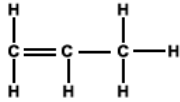
Question number	Answer	Notes	Marks
2 (a)	electron(s)		1
(b)	nucleus		1
(c)	<b>M1</b> proton(s) <b>M2</b> neutron(s)	in either order	1 1
(d) (i)	isotope(s)		1
(ii)		ALLOW other symbols for electrons do not need to show nucleus REJECT any diagram showing a lithium ion	1
(e)	<b>M1</b> $[(92.5 \times 7) + (7.5 \times 6)]/100$ <b>M2</b> = 6.9	<b>ACCEPT</b> 6.925 and 6.93 <b>REJECT</b> 7 Incorrect rounding e.g. 6.92 scores 1 <b>IGNORE</b> units	2

**Total 8 marks**

Question number	Answer	Notes	Marks						
3 (a)	<b>B</b> neutralisation		1						
(b) (i)	<table border="1" data-bbox="477 358 1016 591"> <tr> <td>after adding acid</td> <td>26.30</td> </tr> <tr> <td>before adding acid</td> <td>1.75</td> </tr> <tr> <td>volume added</td> <td>24.55</td> </tr> </table> <p data-bbox="384 622 509 656"><b>M1</b> 26.30</p> <p data-bbox="384 696 493 730"><b>M2</b> 1.75</p> <p data-bbox="384 763 509 797"><b>M3</b> 24.55</p>	after adding acid	26.30	before adding acid	1.75	volume added	24.55	<p data-bbox="1043 327 1326 456">If readings are correct but in wrong order, award 1 mark for M1 and M2</p> <p data-bbox="1043 730 1289 801"><b>M3</b> ECF from (M1 - M2)</p> <p data-bbox="1043 835 1321 907">Penalise an answer not to 2dp once only</p>	3
after adding acid	26.30								
before adding acid	1.75								
volume added	24.55								
(ii)	<p data-bbox="384 1010 564 1043">Any two from</p> <p data-bbox="384 1077 975 1111"><b>M1</b> to obtain (two) concordant results/titres</p> <p data-bbox="384 1417 975 1489"><b>M2</b> to identify anomalous results/first result may be anomalous</p> <p data-bbox="384 1585 874 1657"><b>M3</b> to obtain a mean (of concordant results/titres)</p>	<p data-bbox="1043 1077 1289 1178">Or equivalent e.g. titres within up to 0.2 cm<sup>3</sup></p> <p data-bbox="1043 1211 1321 1312">ALLOW to obtain (very) similar results OWTTE</p> <p data-bbox="1043 1417 1302 1547">ALLOW reference to overshooting the end point on the first titration</p> <p data-bbox="1043 1585 1233 1619">ALLOW average</p>	2						

Total 6 marks

Question number	Answer	Notes	Marks
4 (a) (i)	$C_3H_8O$	Penalise incorrect use of lowercase letters and subscripts  ALLOW symbols in any order e.g. $C_3OH_8$ REJECT $C_3H_7OH$	1
(ii)	<p><b>M1</b> (correct as X) only contains single bonds</p> <p><b>M2</b> (not correct as X) contains oxygen/O</p> <p><b>M3</b> hydrocarbon contains hydrogen/H and carbon/C only</p>	ALLOW no double bonds  REJECT if they say it is unsaturated  IGNORE $O_2$  ALLOW (not correct as X) is an alcohol  REJECT if they say it is a hydrocarbon  REJECT hydrogen and carbon molecules	3
(b)	Any one from: <ul style="list-style-type: none"> <li>• have a general formula</li> <li>• successive members differ by <math>CH_2</math></li> <li>• trends in physical properties</li> <li>• same functional group</li> </ul>	IGNORE reference to chemical properties	1

Question number	Answer	Notes	Marks
4 (c) (i)	catalyst	ALLOW description of effect of catalyst e.g. to speed up the reaction/ to lower the activation energy  IGNORE to dehydrate compound X	1
(ii)	insoluble (in water)	IGNORE reference to density ALLOW (only) slightly soluble in water	1
(iii)	contains air	ALLOW contains oxygen IGNORE contains other gases	1
(iv)	  M1	IGNORE bond angles  ALLOW H-O-H	2
(v)	M2 H <sub>2</sub> O  propene		1

Total 11 marks



Question number	Answer	Notes	Marks						
5 (a)	<table border="1" data-bbox="411 286 858 465"> <tr> <td data-bbox="411 286 603 344">Fe</td> <td data-bbox="603 286 858 344">iron</td> </tr> <tr> <td data-bbox="411 344 603 403">Cr</td> <td data-bbox="603 344 858 403">chromium</td> </tr> <tr> <td data-bbox="411 403 603 465">O</td> <td data-bbox="603 403 858 465">oxygen</td> </tr> </table>	Fe	iron	Cr	chromium	O	oxygen	All three names must be correct	1
Fe	iron								
Cr	chromium								
O	oxygen								
(b) (i)	$\text{Cr}_2\text{O}_3 + 2\text{Al} \rightarrow \text{Al}_2\text{O}_3 + 2\text{Cr}$ <p>M1 <math>\text{Al}_2\text{O}_3</math> M2 completely correct equation</p>		2						
(ii)	<p>M1 aluminium more reactive (than chromium)</p> <p>M2 as aluminium displaces chromium</p>	<p>ORA ALLOW aluminium higher in the reactivity series (than chromium)</p> <p>ALLOW aluminium removes the oxygen from chromium</p>	2						
(iii)	<p>Any two from</p> <p>M1 (redox means both) reduction and oxidation taking place (at same time)</p> <p>M2 chromium reduced and aluminium oxidised</p> <p>M3 chromium (reduced as) loses oxygen and aluminium (oxidised as) gains oxygen</p>	<p>ACCEPT chromium oxide</p> <p>ACCEPT chromium oxide</p> <p>ACCEPT chromium ions gain electrons (so reduced) and aluminium loses electrons (so oxidised)</p> <p>ALLOW answer in terms of oxidation number changes</p>	2						

Question number	Answer	Notes	Marks
5 (c) (i)	<p><b>M1</b> mol (Cr) = <math>0.13/52 = 0.0025</math></p> <p><b>M2</b> vol H<sub>2</sub> = answer to M1 x 24 =</p> <p><b>M3</b> 0.06(0) dm<sup>3</sup></p>	<p>accept 60 cm<sup>3</sup></p> <p>If incorrect moles of H<sub>2</sub> e.g. 0.0025 has been multiplied or divided by 2, ECF to M3, i.e. 0.03 or 0.12 would score 2 marks</p>	3
(ii)	<p>Any two from</p> <p><b>M1</b> (sample of) chromium impure</p> <p><b>M2</b> gas leakage (from apparatus)/some gas escaped (before the bung was inserted)</p> <p><b>M3</b> not enough/less than 0.13g chromium used/did not use excess acid</p> <p><b>M4</b> reaction not allowed to go to completion/the volume was measured before reaction ended</p> <p><b>M5</b> some gas dissolved in the acid/solution</p>		2

Total 12 marks

Question number	Answer	Notes	Marks
6 (a) (i)	$(24 + 16) = 40$		1
(ii)	$\text{Li}^+$ and $\text{F}^-$	both needed	1
(b)	<p>Any four from</p> <p><b>M1</b> strong (electrostatic) forces/attraction</p> <p><b>M2</b> between oppositely charged ions</p> <p><b>M3</b> a large amount of energy needed to overcome attraction / break down lattice/break bonds</p> <p><b>M4</b> (MgO higher melting point as) greater charge on <math>\text{Mg}^{2+}</math> (than <math>\text{Li}^+</math>) / greater charge on <math>\text{O}^{2-}</math> (than <math>\text{F}^-</math>)</p> <p><b>M5</b> EITHER so stronger attraction/forces/bonds (in MgO)</p> <p>OR more (thermal/heat) energy required to overcome attraction / break down lattice/break the bonds (in MgO)/ORA</p>	<p>ACCEPT strong (ionic) bonds</p> <p>Must be a comparison to gain M5</p> <p>MAX 2 if any reference to intermolecular forces/covalent bonding/electron sharing/molecules/metallic bonding</p>	4
(c)	<p><b>M1</b> (when) solid ions in fixed positions/don't move/only vibrate</p> <p><b>M2</b> (when) molten or in solution ions can move/mobile</p>	<p>IGNORE electrons ALLOW atoms</p> <p>REJECT electrons/atoms</p> <p>MAX 1 if mention of sharing of electrons/covalent bonding</p>	2

Total 8 marks

Question number	Answer	Notes	Marks
7 (a) (i)	<p><b>M1</b> oxidation is loss of electrons</p> <p><b>M2</b> chloride ions/Cl<sup>-</sup> lose electrons (so oxidised)</p>	<p>REJECT chlorine/Cl/Cl<sub>2</sub> loses electrons</p> <p>ALLOW chloride loses electrons</p>	2
(ii)	<p><math>2\text{H}_2\text{O} + 2\text{e}^- \rightarrow 2\text{OH}^- + \text{H}_2</math></p> <p><b>M1</b> all correct species</p> <p><b>M2</b> correctly balancing</p> <p>M2 dep on M1</p>	ACCEPT multiples	2
(b)	$\text{Cl}_2 + 2\text{NaOH} \rightarrow \text{NaCl} + \text{NaOCl} + \text{H}_2\text{O}$	ACCEPT multiples	1
(c) (i)	<p><b>M1</b> monomers join together/ double bonds broken (in monomers)</p> <p><b>M2</b> to form a long chain (molecule)/large molecule</p>	ALLOW link/add in place of join	2
(ii)	<p><b>M1</b> correct repeat structure</p> <p><b>M2</b> brackets and continuation bonds and n</p>	<p>No M1 if more than 1 repeat unit shown</p> <p>ACCEPT n anywhere after the brackets but not before</p> <p>REJECT any structure with a double bond for both marks</p>	2

Total 9 marks

Paper Total 60 marks

