



# Mark Scheme (Results)

Summer 2016

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

Pearson Edexcel Level 1/Level 2 Certificate  
in Chemistry (KCH0 2C)

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Publications Code 4CH0\_2C\_1606\_MS

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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)	<b>M1</b> (X) – (stirring/glass/ plastic) rod  <b>M2</b> (Y) – Bunsen (burner)	Accept stirrer Reject metal	2
(b) (i)	<b>C</b> (solvent)		1
(ii)	<b>B</b> (solution)		1
(c) (i)	2		1
(ii)	3		1
(d)	evaporated / went into the air	accept boils accept turns into vapour	1

Question number	Answer	Notes	Marks
2 (a)	<p><b>M1</b> <u>iron</u> reacted with <u>oxygen</u></p> <p><b>M2</b> <u>all oxygen</u> is reacted / (all) <u>oxygen</u> used up / no <u>oxygen</u> left</p>	<p>Accept <u>iron</u> combined/bonded with <u>oxygen</u>  Accept iron oxide formed  Accept iron is oxidised  Ignore iron uses oxygen  Ignore iron rusts  Ignore references to reacting with water</p> <p>Accept references to 20% or 20cm<sup>3</sup> of the air which is <u>oxygen</u> used up/reacted</p> <p>Reject all iron used up  Ignore reaction has finished</p>	2
(b)	<p><b>M1</b> iron(II) sulfate / iron sulfate</p> <p><b>M2</b> hydrogen</p>	reject any other oxidation state	2

(c)	<b>M1</b> ( $\text{Fe}^{2+}$ ) – green precipitate/solid  <b>M2</b> ( $\text{Fe}^{3+}$ ) – brown precipitate/solid	ignore shades reject other colours eg blue- green  accept red-brown / orange brown Ignore rust coloured  reject red on its own  Allow 1 mark if both answers correct but reversed  Ignore references to colours of solutions	2
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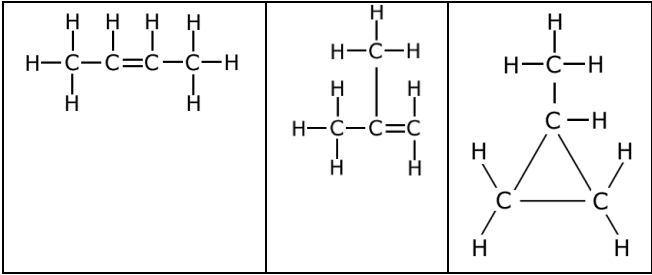
Question number	Answer	Notes	Marks
3 (a)	<p>(i) Na / sodium / Mg / magnesium</p> <p>(ii) Si / silicon / P / phosphorus / S / sulfur / Cl / chlorine</p>	<p>Ignore name and formula of compound</p> <p>Accept aluminium If both name and formula given both must be correct</p> <p>If both name and formula given both must be correct</p>	<p>1</p> <p>1</p>
(b) (i)	<p><math>[\text{Mg}]^{2+} \quad [:\ddot{\text{Cl}}:]^{-} \quad [:\ddot{\text{Cl}}:]^{-}</math></p> <p><b>M1</b> correct electronic configuration for magnesium ion and correct charge on ion</p> <p><b>M2</b> correct electronic configuration for both chloride ions</p> <p><b>M3</b> correct charges on both chloride ions</p>	<p>Allow electrons on brackets</p> <p>Allow any combination of dots and crosses</p> <p>Allow 0 or 8 electrons in outer shell</p> <p>M3 indep</p>	<p>3</p> <p>2</p>
(ii)	<p><b>M1</b> electrostatic attraction/forces between ions</p> <p><b>M2</b> of opposite charge</p>	<p>accept positive</p>	

(iii)	<p><b>M1</b> attraction (between ions) is strong</p> <p><b>M2</b> lots of ions (in structure) / giant structure / lattice / lots of/many bonds</p> <p><b>M3</b> (therefore) lot of (thermal/heat) <u>energy</u> required to overcome attraction / to break down the lattice</p>	<p>and negative ions accept cations and anions M2 dep on M1 Accept attraction/forces between oppositely charged ions for 1 mark only Reject references to atoms/molecules/IMF for M1 and M2</p> <p>Accept strong (ionic) bonding/strong ( ionic) bonds</p> <p>Accept lot of (thermal/heat) <u>energy</u> required to break (ionic) bonds</p> <p>If any reference to attraction between atoms/molecules/electrons scores 0/3 If any reference to covalent bonding/covalent structure/IMF scores 0/3</p>	3
(c)		Correct answer with or without working scores 2 marks	2



	<p><b>M1</b> mol Al = <math>20/3</math> (= 6.67)</p> <p><b>M2</b> mass Al = (answer to M1 x 27) = 180 (g)</p> <p><b>OR</b></p> <p><b>M1</b> 3 faradays give 1 mol <b>OR</b> 27 g / 30 faradays give 10 mol <b>OR</b> 270 g</p> <p><b>M2</b> 20 faradays gives 180 (g)</p>	<p>M2 CQ on M1 eg 540 scores 1 mark 6.67 gives 180(.09) scores 2 marks 6.7 gives 180.9 = 181 scores 2 marks 6.66 gives 179.82 scores M2 only Accept any number of sig fig except 1</p>	
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Question number	Answer	Notes	Marks
4 (a)	$\text{CuO} + 2\text{HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + \text{H}_2\text{O}$	Ignore state symbols	1
(b) (i)	to increase the rate of <u>reaction</u>	ignore references to dissolving/solubility	1
(b) (ii)	(copper(II) oxide/it) stops disappearing/ stays as a solid / forms as a solid (at the bottom of the beaker)	Accept stops dissolving / forms a suspension /forms a residue  Accept when copper oxide remains/settles in the beaker Allow liquid goes cloudy/black  ignore references to stops reacting ignore references to bubbling	1
(iii)	a drop of solution forms crystals when removed (and cooled)	Accept when crystals start to form/start to be seen  Reject if all water evaporated	1
(iv)	(stage) 3	accept any reference to <u>first</u> filtration stage	1

Question number	Answer	Notes	Mark
5 (a) (i)	<p><b>M1</b> (compounds/molecules with the) same molecular formula /same number of each type of atom</p> <p><b>M2</b> but different displayed formula / structural formula / structures / arrangement of atoms</p>	<p>Ignore references to chemical/general/empirical formula</p> <p>If use elements/atoms instead of compounds/molecules can score M2 only</p> <p>Allow reference to isomers in question ie have same number of carbon and hydrogen (atoms as each other)</p> <p>Ignore atoms in different order</p> <p>Ignore references to stereoisomerism</p>	2
(ii)	 <p>Any one for 1 mark</p>	<p>Accept structure of trans but-2-ene</p> <p>Ignore bond angles</p>	1
(iii)	<p><b>M1</b> (Reagent) – bromine (water)</p> <p><b>M2</b> (But-1-ene) – goes (from orange) to colourless</p> <p><b>M3</b> (cyclobutane) – no change (unless UV light present )</p>	<p>accept decolourised</p> <p>Ignore clear/discolours</p> <p>accept stays orange</p> <p>ignore no reaction</p> <p>If start with bromine (water) in presence of UV light then scores 0/3</p>	3

(b) (i)	$  \begin{array}{cccc}  \text{H} & \text{H} & \text{H} & \text{H} \\    &   &   &   \\  \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{H} \\    &   &   &   \\  \text{H} & \text{OH} & \text{H} & \text{H}  \end{array}  $ <p>OR</p> $  \begin{array}{cccc}  \text{H} & \text{H} & \text{H} & \text{H} \\    &   &   &   \\  \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{H} \\    &   &   &   \\  \text{OH} & \text{H} & \text{H} & \text{H}  \end{array}  $	Allow -O-H and -OH but not -HO	1
(ii)	$  \left( \begin{array}{cc}  \text{H} & \text{H} \\    &   \\  \text{---} \text{C} & \text{---} \text{C} \text{---} \\    &   \\  \text{C}_2\text{H}_5 & \text{H}  \end{array} \right)_n  $ <p><b>M1</b> correct formula of repeat unit (with carbon to carbon single bond)</p> <p><b>M2</b> brackets <u>and</u> continuation bonds <u>and</u> n</p>	<p>Accept displayed C<sub>2</sub>H<sub>5</sub></p> <p>Accept C<sub>2</sub>H<sub>5</sub> on either C Allow if more than one monomer correctly joined together</p> <p>Accept n anywhere after brackets but not before</p> <p>M2 dep on M1 or near miss</p>	2

Question number	Answer	Notes	Marks								
6 (a)	titration / <u>volumetric</u> analysis		1								
(b)	<b>C</b> (25 cm <sup>3</sup> pipette)		1								
(c)	<b>M1</b> (before) – yellow <b>M2</b> (after) - orange	accept pink / red and combinations with orange Allow 1 mark if correct colours reversed	2								
(d)	<table border="1" style="display: inline-table; vertical-align: top;"> <tr> <td>after adding acid</td> <td>23.60</td> </tr> <tr> <td>before adding acid</td> <td>2.75</td> </tr> <tr> <td>volume added</td> <td>20.85</td> </tr> </table> <b>M1</b> 23.60 <b>M2</b> 2.75 <b>M3</b> 20.85	after adding acid	23.60	before adding acid	2.75	volume added	20.85	If readings are correct but in the wrong order, award 1 mark for M1 and M2  M3 CQ on (M1 – M2)	3		
after adding acid	23.60										
before adding acid	2.75										
volume added	20.85										
(e) (i)	<table border="1" style="display: inline-table; vertical-align: top;"> <tr> <td>22.90</td> <td>22.60</td> <td>22.45</td> <td>22.55</td> </tr> <tr> <td></td> <td>✓</td> <td>✓</td> <td>✓</td> </tr> </table>	22.90	22.60	22.45	22.55		✓	✓	✓		1
22.90	22.60	22.45	22.55								
	✓	✓	✓								
(ii)	<b>M1</b> $(22.60 + 22.45 + 22.55) \div 3$  <b>M2</b> 22.53 (cm <sup>3</sup> )	Correct final answer with no working scores (2) Accept 22.53 with 3 recurring  If no results ticked in (i), then only use of two or three concordant titres can score in (ii)  If only one result ticked, then no marks can be scored in (ii) Otherwise, both marks CQ on ticked results in (e)(i)  Answer with zero as 2nd dp does not need trailing zero	2								

		Answers obtained by averaging other titre values do require answers to 2 dp	
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Question number	Answer	Notes	Marks
7 (a)	(refinery) gases		1
	(b) bitumen		1
(c) (i)	<p><math>C_{18}H_{38} \rightarrow C_8H_{18} + C_{10}H_{20}</math></p> <p><b>OR</b></p> <p><math>C_{18}H_{38} \rightarrow C_8H_{18} + 2C_5H_{10}</math></p> <p><b>OR</b></p> <p><math>C_{18}H_{38} \rightarrow C_8H_{18} + 5C_2H_4</math></p>		1
(ii)	<p><b>Any two from:</b></p> <p>M1 over/greater supply of long chain hydrocarbons/molecules/ heavy/heavier fractions / OWTTE</p> <p>M2 high(er) demand/more use for short-chain/small hydrocarbons/ light/lighter fractions/ OWTTE</p> <p>M3 reference to a use eg the alkenes produced can be used to make polymers/plastics / eg the short-chain (saturated) hydrocarbons used as fuels</p>	<p>Accept reverse argument eg not enough short chain hydrocarbons</p> <p>Accept specific alkene and product eg ethene to make poly(ethene)/ethanol/alcohol Accept answers in terms of gasoline/petrol / fuel (for cars)</p>	2
(d)	<p><math>C_8H_{18} + 8\frac{1}{2}O_2 \rightarrow 8CO + 9H_2O</math></p> <p><b>M1</b> correct formula for CO</p> <p><b>M2</b> correct balanced equation</p> <p><b>M2</b> dep on <b>M1</b></p>	<p>Allow multiples</p> <p>Accept balanced equations containing CO as well as C and/or CO<sub>2</sub> eg <math>C_8H_{18} + 6.5O_2 \rightarrow 4CO + 4C + 9H_2O</math></p>	2

Question number	Answer	Notes	Marks
8 (a)	<p><b>M1</b> (mol <math>\text{NaHCO}_3 =</math>) <math>10.5/84</math> or <math>0.125</math></p> <p><b>M2</b> (so mass <math>\text{CO}_2 = 0.0625 \times 44 =</math> ) <math>2.8</math> (g)</p> <p><b>OR</b></p> <p><b>M1</b> <math>168 \text{ g NaHCO}_3</math> give <math>44 \text{ g CO}_2</math></p> <p><b>M2</b> <math>10.5 \text{ g NaHCO}_3</math> give <math>2.75 \text{ g CO}_2</math></p>	<p>correct final answer with no working scores 2 accept 2.75 M2 CQ on M1</p>	2
(b)	<p><b>M1</b> (mol <math>\text{CO}_2 =</math>) <math>2.75 \div 44</math> or <math>0.0625</math></p> <p><b>M2</b> <math>(0.0625 \times 24000) = 1500 \text{ (cm}^3\text{)}</math></p>	<p>correct final answer with no working scores 2 if answer is incorrect mark CQ to (a)</p> <p>CQ answer to M1 accept <math>1.5(00) \text{ dm}^3</math></p>	2



