



Pearson

# Mark Scheme (Results)

January 2018

Pearson Edexcel International Advanced  
Level In Chemistry (WCH06) Paper 01  
Chemistry Laboratory Skills II

edexcel 

## **Edexcel and BTEC Qualifications**

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at [www.edexcel.com](http://www.edexcel.com) or [www.btec.co.uk](http://www.btec.co.uk). Alternatively, you can get in touch with us using the details on our contact us page at [www.edexcel.com/contactus](http://www.edexcel.com/contactus).

## **Pearson: helping people progress, everywhere**

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: [www.pearson.com/uk](http://www.pearson.com/uk)

January 2018

Publications Code WCH06\_01\_1801\_MS

All the material in this publication is copyright

© Pearson Education Ltd 2018

## 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	Acceptable Answer	Reject	Mark
<b>1(a)</b>	(Contains) a transition metal (ion) / a transition element  ALLOW a d-block element (Might contain) chromate(VI) ions/ $\text{CrO}_4^{2-}$ / Iron(III) (ions)/ $\text{Fe}^{3+}$ / $\text{PbI}_2$ / $\text{AgI}$	Dichromate (ions) / $\text{Cr}_2\text{O}_7^{2-}$ / $\text{Cr}^{6+}$	<b>(1)</b>

Question Number	Acceptable Answer	Reject	Mark
<b>1(b)</b>	$\text{Na}^+$ (ion) / sodium (cat)ion present  ALLOW  Na ion $\text{Na}_2\text{CrO}_4$	<b>Just</b> 'Na' / sodium   $\text{Na}_2\text{Cr}_2\text{O}_7$ NaCl / any other sodium compounds	<b>(1)</b>

Question Number	Acceptable Answer	Reject	Mark
<b>1(c)</b>	$\text{Cr}_2\text{O}_7^{2-}$ $(\text{Cr}_2\text{O}_7)^{2-}$	$\text{CrO}_4^{2-}$ $\text{Na}_2\text{Cr}_2\text{O}_7$	<b>(1)</b>

Question Number	Acceptable Answer	Reject	Mark
<b>1(d)</b>	<p><b>1st mark:</b>  <math>\text{Cr}_2\text{O}_7^{2-}</math> / dichromate(VI) / chromium(VI) <b>reduced</b></p> <p>ALLOW</p> <p>Chromium is <b>reduced</b></p> <p>OR</p> <p>ethanol is <b>oxidised</b></p> <p>OR</p> <p>ethanol forms ethanoic acid / ethanol forms ethanal (1)</p> <p><b>2nd mark:</b>  <math>\text{Cr}^{3+}</math> / chromium(III) / Cr(III) (ions) formed (1)</p> <p>Mark scoring points independently</p>	<p><math>\text{Cr}^{6+}</math> is reduced</p> <p>Just 'oxidation' or 'reduction' or 'redox'</p>	<b>(2)</b>

Question Number	Acceptable Answer	Reject	Mark
<b>1(e)</b>	<p><b>1st mark:</b>  (Green precipitate formula is)</p> <p><math>\text{Cr}(\text{OH})_3(\text{H}_2\text{O})_3</math> / <math>\text{Cr}(\text{OH})_3</math> (1)</p> <p><b>2nd mark:</b>  (Ion responsible for green colour of solution)</p> <p><math>\text{Cr}(\text{OH})_6^{3-}</math></p> <p>ALLOW</p> <p><math>\text{Cr}(\text{OH})_4^-</math> / <math>\text{Cr}(\text{OH})_5^{2-}</math> / <math>\text{CrO}_2^-</math> / <math>\text{CrO}_3^{3-}</math> (1)</p> <p>IGNORE  Any number of <math>\text{H}_2\text{O}</math> ligands included with <math>\text{Cr}(\text{OH})_4^-</math> / <math>\text{Cr}(\text{OH})_5^{2-}</math></p>	<p><math>\text{Cr}_2\text{O}_3</math></p> <p><math>\text{Cr}^{3+}</math> / <math>[\text{Cr}(\text{H}_2\text{O})_6]^{3+}</math></p>	<b>(2)</b>

Question Number	Acceptable Answer	Reject	Mark
<b>1(f)</b>	<p><b>1st mark:</b> (Ion responsible for pale blue colour of solution) <math>\text{Cr}(\text{H}_2\text{O})_6^{2+} / \text{Cr}^{2+}</math> (1)</p> <p><b>2nd mark:</b> (Role of the Zn)</p> <p>Reducing agent / reduces / reduction / loses electrons / donates electrons (1)</p> <p>IGNORE References to redox Mark independently</p>	$\text{Cu}^{2+}$	<b>(2)</b>

Question Number	Acceptable Answer	Reject	Mark
<b>1(g)</b>	<p><b>1st mark:</b> (Ion responsible for green colour of the solution)</p> <p><math>\text{Cr}(\text{H}_2\text{O})_6^{3+} ((\text{aq})) / \text{Cr}^{3+} ((\text{aq}))</math> (1)</p> <p><b>2nd mark:</b> (Type of reaction)</p> <p>Oxidation</p> <p>ALLOW 'redox' (1)</p> <p>Mark independently</p>	<p>Other numbers of water ligands</p> <p>Reduction Ligand exchange</p>	<b>(2)</b>

**(Total for Question 1 = 11 marks)**

Question Number	Acceptable Answer	Reject	Mark
<b>2(a)(i)</b>	<p>EITHER</p> <p>(<b>Y</b> contains an)</p> <p>OH (group) / hydroxy(l) (group)</p> <p>OR</p> <p>(<b>Y</b> is an) alcohol <b>or</b> a carboxylic acid</p> <p>OR</p> <p>(<b>Y</b> contains) an OH <b>or</b> a COOH (group)</p> <p>OR</p> <p>(<b>Y</b> is) propanol <b>or</b> propanoic acid / propan-1-ol <b>or</b> propan-2-ol <b>or</b> propanoic acid</p> <p>Note The significance of '<b>or</b>'</p>	"hydroxide/ OH <sup>-</sup> "	<b>(1)</b>

Question Number	Acceptable Answer	Reject	Mark
<b>2(a)(ii)</b>	<p>(<b>Y</b> is) NOT a (carboxylic) acid / does not contain a carboxyl group</p> <p>ALLOW</p> <p>(<b>Y</b> is) an alcohol</p>	Does not contain a carboxylate group	<b>(1)</b>

Question Number	Acceptable Answer	Reject	Mark
<b>2(a)(iii)</b>	<p>(Y contains a)  <math>\text{CH}_3\text{CH}(\text{OH})</math> group /            (Y is a) secondary methyl alcohol /  <math>2^\circ</math> alcohol with methyl group next to            C-OH</p> <p>ALLOW</p> <p>Secondary alcohol with methyl group            next to the functional group</p> <p>OR</p> <p>(Y is) propan-2-ol</p> <p>IGNORE</p> <p>References to methyl ketone /            ethanol / just 'secondary alcohol' /            just 'CHOH group'</p>		<b>(1)</b>

Question Number	Acceptable Answer	Reject	Mark
<b>2(a)(iv)</b>	<p>(Y is) propan-2-ol / <math>\text{CH}_3\text{CH}(\text{OH})\text{CH}_3</math></p> <p>ALLOW</p> <p>Skeletal / displayed formula</p>	<p>propanol</p> <p>Just <math>\text{C}_3\text{H}_8\text{O}</math></p>	<b>(1)</b>

Question Number	Acceptable Answer	Reject	Mark
<b>2(a)(v)</b>	<p><b>1st mark:</b>            (Peak caused by)</p> <p><math>\text{CH}_3\text{CHOH}^+</math> / <math>\text{C}_2\text{H}_5\text{O}^+</math></p> <p>ALLOW</p> <p>TE on structure in (iv) e.g.  <math>\text{CH}_2\text{CH}_2\text{OH}^+</math> if propan-1-ol given in            (iv) (1)</p> <p><b>2nd mark:</b>            (Species is formed by)            (Fragmentation of molecular ion by)            loss of a <math>\text{CH}_3</math> group / <math>\bullet\text{CH}_3</math> /  <math>\text{CH}_3</math> radical / methyl group / methyl            radical</p> <p>ALLOW</p> <p>Breaking a single carbon to carbon            bond</p> <p>Loss of <math>\text{CH}_3^+</math> (1)</p>	<p>MP1 if + sign            missing</p> <p><math>\text{CH}_3\text{CH}_2\text{O}^+</math></p> <p>Loss of <math>\text{CH}_3^-</math></p>	<b>(2)</b>

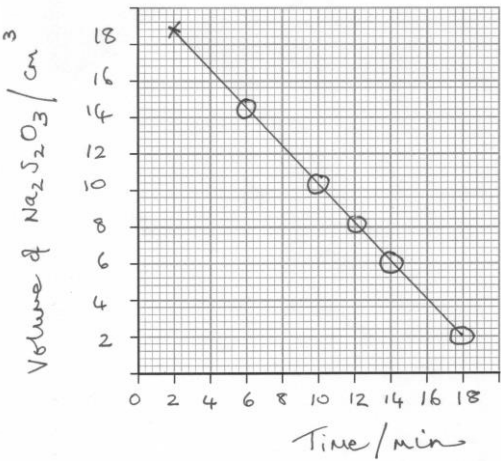


Question Number	Acceptable Answer	Reject	Mark
<b>2(b)(i)</b>	Hydrogen chloride / HCl / HCl(g) / HCl(gas)  ALLOW Hydrochloric acid/ HCl(aq)		<b>(1)</b>

Question Number	Acceptable Answer	Reject	Mark
<b>2(b)(ii)</b>	( <b>Z</b> contains the functional group) Carboxylic acid / (-)COOH / (-)CO <sub>2</sub> H  ALLOW  Carboxylic group / carboxyl group  IGNORE Just 'acid' Carbon dioxide is produced	'Carboxylate'	<b>(1)</b>

Question Number	Acceptable Answer	Reject	Mark
<b>2(b)(iii)</b>	( <b>Z</b> is) Propanoic acid / CH <sub>3</sub> CH <sub>2</sub> COOH / CH <sub>3</sub> CH <sub>2</sub> CO <sub>2</sub> H / C <sub>2</sub> H <sub>5</sub> COOH / C <sub>2</sub> H <sub>5</sub> CO <sub>2</sub> H  ALLOW Skeletal or displayed formula		<b>(1)</b>

**(Total for Question 2 = 9 marks)**

Question Number	Acceptable Answer	Reject	Mark
<b>3(a)(i)</b>	 <p><b>1st mark:</b></p> <p>Both axes labelled, with units ALLOW units in brackets (1)</p> <p><b>2nd mark:</b></p> <p>'Sensible' scale, covering more than half the grid in each direction (1)</p> <p><b>3rd mark:</b></p> <p>All six points plotted correctly (1)</p> <p><b>4th mark:</b></p> <p><b>Straight line</b> of best fit ALLOW If a non-uniform scale is used (1)</p>	<p>If units missing, no MP1</p> <p>Non-uniform scale</p> <p>Reject if a non-uniform scale is used in MP2</p> <p>point-to-point' if misplot/ curve of any description</p>	<b>(4)</b>

Question Number	Acceptable Answer	Reject	Mark
<b>3(a)(ii)</b>	<p>The iodine concentration is proportional to the titre / volume of thiosulfate</p> <p>IGNORE</p> <p>Use of 1:2 ratio</p>		<b>(1)</b>

Question Number	Acceptable Answer	Reject	Mark
<b>3(a)(iii)</b>	<p>The concentrations of the propanone and hydrochloric acid are (effectively) constant (during the reaction) (1)</p> <p>(So that) <b>only</b> the iodine concentration changes (during the reaction)</p> <p>ALLOW Iodine concentration is the <b>only</b> variable</p> <p>(So) the order is that with respect to iodine <b>alone</b> (1)</p>		<b>(2)</b>

Question Number	Acceptable Answer	Reject	Mark
<b>3(a)(iv)</b>	<p>Zero (order) / 0 (order) / <math>c = 0</math> (1)</p> <p>(The straight line graph shows) rate is independent of <math>I_2</math> concentration / rate (of decrease of <math>I_2</math> concentration) is constant / gradient is constant (1)</p>	Just 'the graph is a straight line'	<b>(2)</b>

Question Number	Acceptable Answer	Reject	Mark
<b>3(b)(i)</b>	<p>Starch (solution) (1)</p> <p>From blue-black / from blue / from black to colourless (1)</p> <p>IGNORE 'Clear'</p> <p>Colour <b>change</b> is needed for this mark</p>	Purple /Pale blue Off white	<b>(2)</b>

Question Number	Acceptable Answer	Reject	Mark
<b>3(b)(ii)</b>	(When solution/reaction mixture is) pale-yellow / 'straw' coloured (1)  IGNORE 'Near end-point'  To prevent the formation of an <b>insoluble</b> complex/ <b>insoluble</b> compound / <b>insoluble</b> substance / <b>insoluble</b> starch-iodine complex (1)	Just 'yellow' Just 'goes pale'	<b>(2)</b>

Question Number	Acceptable Answer	Reject	Mark
<b>3(c)</b>	Titre is small(est) (so the (relative) uncertainty/(relative) error is greatest)		<b>(1)</b>

Question Number	Acceptable Answer	Reject	Mark
<b>3(d)</b>	(Order is) first / 1st / 1 (1)  Doubling the concentration (of the acid) doubles the <b>rate</b> (1)	'Speed' instead of rate	<b>(2)</b>

Question Number	Acceptable Answer	Reject	Mark
<b>3(e)</b>	Any ONE of the following matching pairs:		<b>(2)</b>
	Colorimetry (1) <b>I<sub>2</sub></b> colour decreases / changes ALLOW Iodine / I <sub>2</sub> is coloured		
	Brown to colourless (1) ALLOW		
	Conductivity (1) Increase in <b>ion / H<sup>+</sup> / I<sup>-</sup></b> concentration (1)		
	OR		
	pH (1) Increase in H <sup>+</sup> concentration (1)	Increase in pH	
	OR		
	Acid-base titration (1) Increase in H <sup>+</sup> concentration (1)		
	OR		
	AgNO <sub>3</sub> titration (1) Increase in I <sup>-</sup> concentration (1)		

**(Total for Question 3 = 18 Marks)**

Question Number	Acceptable Answer	Reject	Mark
<b>4(a)</b>	<p><b>1st mark:</b></p> <p>(As liquid boils / vaporises), it / vapour is cooled and condensed (back to liquid) (1)</p> <p><b>2nd and 3rd marks:</b></p> <p>Any TWO from</p> <ul style="list-style-type: none"> <li>• Prevents escape of reactants / products / flammable liquids / flammable vapours / volatile liquids</li> <li>• Enables (in)flammable / harmful liquids to be heated safely</li> <li>• Allows time for reaction / allows for a complete reaction / increases rate of reaction / increases yield (of product) / overcome the activation energy (for the reaction) (2)</li> </ul>		<b>(3)</b>

Question Number	Acceptable Answer	Reject	Mark
<b>4(b)(i)</b>	<p>To remove / react with the (excess/unreacted) <b>ethanoyl chloride</b></p> <p>ALLOW</p> <p>Hydrolysis of the <b>ethanoyl chloride</b></p>	Cool down / dilute the mixture / solution	<b>(1)</b>

Question Number	Acceptable Answer	Reject	Mark
<b>4(b)(ii)</b>	<p>The reaction (with water) is (very) exothermic / gives out heat / is violent / is vigorous</p> <p>IGNORE</p> <p>explosive</p>		<b>(1)</b>

Question Number	Acceptable Answer	Reject	Mark
<b>4(c)</b>	(Filtration is) faster / quicker (1)  Dries the solid / dries the precipitate / dries the crystals OR Removes the maximum amount of solution  IGNORE References to 'higher yield' / 'less product lost' / fewer 'transfer losses' (1)		<b>(2)</b>

Question Number	Acceptable Answer	Reject	Mark
<b>4(d)</b>	'Sharp' melting temperature / melts over a 1-2°C range / melts over a 'narrow' temp range (1)  Value (of melting temperature is) consistent with literature value / Internet value  ALLOW 'Correct value' (obtained) (1)	Sharper melting temperature narrower	<b>(2)</b>

Question Number	Acceptable Answer	Reject	Mark
<b>4(e)</b>	<p>SCROLL DOWN TO CHECK WHOLE SPACE</p> <p>TE is allowed at each stage</p> <p><u>Correct answer with no working scores 3</u></p> <p>IGNORE</p> <p>SF except 1 SF</p> <p>Moles of <math>C_7H_7NO_2</math>  <math>(= \frac{3.70}{137}) = 0.027007299</math>  <math>= 0.0270 \text{ (mol)}</math> (1)</p> <p>Actual moles of product, <math>C_9H_9NO_3</math>  <math>(= \frac{2.42}{179}) = 0.013519553</math>  <math>= 0.0135 \text{ (mol)}</math> (1)</p> <p>% yield <math>(= \frac{0.0135}{0.0270} \times 100\%)</math>  <math>= 50\%</math> (1)</p> <p>OR</p> <p>Alternative route for MP2 and MP3</p> <p>Expected mass of product, <math>C_9H_9NO_3</math>  <math>(= 0.0270 \times 179) = 4.833 \text{ (g)}</math> (1)</p> <p>% yield <math>(= \frac{2.42}{4.833} \times 100\%)</math>  <math>= 50.07241879\%</math>  <math>= 50.1\%</math> (1)</p>	<p>Just  <math>\frac{2.42}{3.70} \times 100</math>  <math>= 65.4\%</math></p>	<b>3</b>



	<p>OR FURTHER ALTERNATIVE ROUTE</p> <p>Expected moles of product, C<sub>9</sub>H<sub>9</sub>NO<sub>3</sub>  <math>\frac{3.70}{137} = 0.027007299</math> (1)</p> <p>Expected mass of product, C<sub>9</sub>H<sub>9</sub>NO<sub>3</sub>  <math>0.027007299 \times 179 = 4.834(\text{g})</math> (1)</p> <p>% yield (<math>= \frac{2.42}{4.834} \times 100\%</math>)  <math>= 50.06206041\%</math>  <math>= 50.1\%</math> (1)</p> <p>NOTE  Final answer will depend on figures held in calculator by candidate – all working must be checked  e.g if all numbers held in calculator, value equals  50.0588857 %</p>		
--	---	--	--

**(Total for Question 4 = 12 Marks)**

**TOTAL FOR PAPER = 50 MARKS**