

Mark Scheme (Results)

January 2015

Pearson Edexcel International GCSE in  
Chemistry (4CHO) Paper 1C

Pearson Edexcel Certificate in  
Chemistry (KCH0) Paper 1C

## **Edexcel and BTEC Qualifications**

Edexcel and BTEC qualifications come from Pearson, the world's leading learning company. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information, please visit our website at [www.edexcel.com](http://www.edexcel.com).

Our website subject pages hold useful resources, support material and live feeds from our subject advisors giving you access to a portal of information. If you have any subject specific questions about this specification that require the help of a subject specialist, you may find our Ask The Expert email service helpful.

[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 2015

Publications Code UG040479

All the material in this publication is copyright

© Pearson Education Ltd 2015

## 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 style="text-align: center;"> <input type="checkbox"/>                      <input type="checkbox"/>                      <input checked="" type="checkbox"/> </p>		1
	b	i	A (an electron)	1
		ii	B (a neutron)	1
		iii	B (electrons and protons)	1
	c	isotopes atomic numbers mass numbers		3
<b>Total 7 marks</b>				

Question number	Answer	Notes	Marks																													
2 a i	tick for P = chromatography tick for Q = fractional distillation tick for R = filtration tick for S = simple distillation  <table border="1"> <thead> <tr> <th rowspan="2">Separation</th> <th colspan="4">Method of separation</th> </tr> <tr> <th>Chromatography</th> <th>Simple distillation</th> <th>Filtration</th> <th>Fractional distillation</th> </tr> </thead> <tbody> <tr> <td>P red ink from a mixture of coloured inks</td> <td style="text-align: center;">✓</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Q ethanol from a mixture of ethanol and water</td> <td></td> <td></td> <td></td> <td style="text-align: center;">✓</td> </tr> <tr> <td>R sand from a mixture of sand and water</td> <td></td> <td></td> <td style="text-align: center;">✓</td> <td></td> </tr> <tr> <td>S water from copper(II) sulfate solution</td> <td></td> <td style="text-align: center;">✓</td> <td></td> <td></td> </tr> </tbody> </table>	Separation	Method of separation				Chromatography	Simple distillation	Filtration	Fractional distillation	P red ink from a mixture of coloured inks	✓				Q ethanol from a mixture of ethanol and water				✓	R sand from a mixture of sand and water			✓		S water from copper(II) sulfate solution		✓				1 1 1 1
Separation	Method of separation																															
	Chromatography	Simple distillation	Filtration	Fractional distillation																												
P red ink from a mixture of coloured inks	✓																															
Q ethanol from a mixture of ethanol and water				✓																												
R sand from a mixture of sand and water			✓																													
S water from copper(II) sulfate solution		✓																														
ii	R	Accept (sand from a mixture of) sand and water	1																													
b	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 5px; width: 30px; height: 30px; text-align: center; margin: 5px;">B</div> <div style="border: 1px solid black; padding: 5px; width: 30px; height: 30px; text-align: center; margin: 5px;">E</div> <div style="border: 1px solid black; padding: 5px; width: 30px; height: 30px; text-align: center; margin: 5px;">A</div> <div style="border: 1px solid black; padding: 5px; width: 30px; height: 30px; text-align: center; margin: 5px;">C</div> <div style="border: 1px solid black; padding: 5px; width: 30px; height: 30px; text-align: center; margin: 5px;">D</div> </div>	M1 for B in first box AND D in last box  M2 for A in box 3 AND C in box 4  M2 dependent on M1 correct	1  1																													
<b>Total 7 marks</b>																																

Question number	Answer	Notes	Marks
3 a	burns with a pop/squeak OR use burning/lit splint/flame to see if pop/squeak	Must be reference to test and result Reference to splint/match with no indication of flame is not enough Ignore flame extinguished Reject reference to glowing splint  Squeaky pop test on its own is not enough	1
b i	anhydrous/white copper sulfate  turns blue OR anhydrous/blue cobalt chloride  turns pink	Ignore colourless Accept correct formula Incorrect formula (eg CuSO) counts as near miss  Accept correct formula Incorrect formula (eg CoCl) counts as near miss  M2 DEP on M1 or near miss	2
ii	measure boiling point / freezing point	Accept boil it / freeze it Ignore heat	2
	100 (°C) / 0 (°C)	Value must match property Ignore units	
		Answers such as boils/distills at 100 °C / freezes at 0 °C score M2 only	

Question number	Answer	Notes	Marks
3 b iii	<p>cross by carbon dioxide from the air reacts to cause the cloudiness cross by the cloudiness is caused by the formation of a white precipitate</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> carbon dioxide forms when the hydrogen burns</li> <li><input checked="" type="checkbox"/> carbon dioxide from the air reacts to cause the cloudiness</li> <li><input type="checkbox"/> the cloudiness is caused by the formation of calcium hydroxide</li> <li><input checked="" type="checkbox"/> the cloudiness is caused by the formation of a white precipitate</li> <li><input type="checkbox"/> the reaction in the limewater is an example of oxidation</li> </ul>	<p>If 3 boxes crossed then max 1 If 4 or more boxes crossed then 0</p>	2
<b>Total 7 marks</b>			

Question number	Answer	Notes	Marks
4 a i	reactants labelled wrong way round / OWTTE	Accept manganese(IV) oxide is the solid OR hydrogen peroxide is the liquid Ignore just manganese(IV) oxide/hydrogen peroxide is wrongly labelled	1
ii	bung / cork	Accept stopper Ignore plug	1
iii	to prevent oxygen/gas from escaping OR (without a bung), oxygen/gas would escape/could not be collected	Do not penalise wrong gas, such as hydrogen	1
b	use a (gas) syringe	Accept collect in gas jar by displacement of air in place of syringe	1
c	2                    2                    (1)	Accept multiples and fractions	1

Question number	Answer	Notes	Marks
4 d	(a substance that) increases rate of reaction / speeds up reaction / decreases time of reaction is (chemically) unchanged (at the end) OR mass does not change	Ignore change/decrease in rate Ignore references to element / compound Accept is not used up / does not change Accept reference to lowering activation energy Ignore reference to alternative route Ignore references to yield Ignore reference to not reacting or taking part in reaction Ignore refs to being physically unchanged Ignore references to starting reaction Reject reference to providing/increasing energy for M2 Reject reference to incorrect statement such as removes impurities for M2	1  1
e	(approximately) vertical line between hydrogen peroxide and top of curve AND labelled activation energy / $E_a$	ignore arrowheads on vertical line	1
	curve starting from hydrogen peroxide line and ending at water + oxygen line AND peak below peak of original curve	Accept near misses, such to and from words Accept curve leaving or joining original curve Do not penalise more than one peak	1
<b>Total 9 marks</b>			

Question number	Answer	Notes	Marks
5 a	i	4	1
	ii	B (hydrated)	1
b	i	aluminium hydroxide AND sodium sulfate	1
	ii	smothers/blankets the fuel/fire / sinks onto to fuel/fire  (therefore) prevents oxygen/air from reaching the fuel/fire	1  1
c	i	Al(OH) <sub>3</sub> has (s) / is solid /is insoluble / its ions not free / its ions not released H <sub>2</sub> SO <sub>4</sub> has (aq) / is a solution AND (H <sup>+</sup> ) ions are released	1  1
	ii	B (5.5)	1
<b>Total 8 marks</b>			

Question number	Answer	Notes	Marks
6 a	C (diffusion)		1
b	ammonia (moves more quickly) AND it travels further /white solid is close(r) to the HCl end / further from the NH <sub>3</sub> end	Ignore reference to solution Ignore reverse argument for HCl Ignore references to reacting more quickly	1
c i	sodium hydroxide / NaOH ammonia / NH <sub>3</sub> blue	Accept other suitable alkalis Reject ammonium Reject all other colours M3 DEP on M2 or near miss	1 1 1
ii	to remove carbonate (ions)/sulfite (ions)	Accept to prevent other ions interfering / to prevent other precipitates from forming Ignore to make sure other reactions do not occur	1
iii	silver nitrate / AgNO <sub>3</sub> silver chloride / AgCl	If both name and formula given, both must be correct	1 1
<b>Total 8 marks</b>			

Question number	Answer	Notes	Marks
7 a	fractional distillation/fractionating column/tower  (crude oil) heated/vaporised / boiled cooler at top/hotter at bottom/idea of temperature gradient fractions condense /separate at different heights/levels fractions have different boiling points/ranges	Reference to fractional / fractionating needed Ignore references to fracking  Accept components / hydrocarbons / compounds / gases Accept separate at different temperatures Ignore references to melting point Any four for 1 mark each If any reference to cracking, MAX 2 M1 - M4 can be scored from suitably labelled diagram	4

Question number	Answer	Notes	Marks
7 b i	$C_nH_{2n+2}$	Do not penalise inappropriate spaces or failure to show 2 and n as subscripts	1
ii	<p>same/similar chemical properties/reactions/behaviour/characteristics</p> <p>gradation / gradual change / trend / increase / decrease of physical properties</p> <p>same functional group (neighbouring) members differ by <math>CH_2</math></p>	<p>Ignore specific examples such as react with oxygen</p> <p>Ignore similar (type of) reactivity</p> <p>Do not penalise reference to trends</p> <p>Accept reference to specific property, eg boiling point</p> <p>Reject same / similar physical properties</p> <p>Ignore variable physical properties</p> <p>Ignore reference to specific group</p> <p>Any two for 1 each</p> <p>Accept two answers on one answer line</p> <p>Ignore any reference to properties not specified as physical or chemical</p>	2
c	(1) 5 3 4	Accept multiples and fractions	1
d i	carbon monoxide / CO		1
ii	reduces capacity of blood to carry oxygen / OWTTE	<p>Accept correct explanation involving haemoglobin</p> <p>Ignore references to carbon monoxide reacting with blood / red blood cells</p>	1
iii	nitrogen/ $N_2$ AND oxygen/ $O_2$	<p>Accept in either order</p> <p>Ignore N and O</p>	1

Question number	Answer	Notes	Marks
7 e	<pre>       H H H H H                 H - C - C - C - C - C - H                       H H H H H         H H H H                 H - C - C - C - C - H                           H   H   H                         H - C - H                           H </pre>	<p>Penalise missing H atoms once only provided all bonds are correctly shown</p> <p>Penalise missing bonds in both structures</p>	<p>1</p> <p>1</p>

Question number	Answer	Notes	Marks
7 f i	<p>setting out correct division of each % by <math>A_r</math> OR 4.4, 11.1 and 1.1</p> <p>division by smallest /ratio of 4 : 10 : 1 <math>C_4H_{10}S_{(1)}</math></p>	<p>Award 0/3 if division by any atomic numbers / wrong way up / multiplication used / wrong atomic mass (eg 16 for C) Do not penalise roundings and minor misreads of % values, eg 11 for H and 36.5 for S If molecular mass used for H, no M1, but can award M2 and M3 but no CQ in ii Using 2 for H gives <math>C_4H_5S</math> Working required for this answer M2 subsumes M1 Accept elements in any order Award 3 for correct final answer with no working No ECF from M2 Accept use of 90 from ii, i.e. <math>90 \times 0.533 = 48</math> etc scores M1 ratio scores M2, answer scores M3</p>	<p>1</p> <p>1</p> <p>1</p>
ii	$C_4H_{10}S_{(1)}$	<p>Accept elements in any order No other answer acceptable</p>	1
<b>Total 17 marks</b>			

Question number	Answer	Notes	Marks
8 a	hydrogen / H <sub>2</sub>	Ignore H	1
b	<u>only</u> single bonds (between carbon atoms) /single bond(s) between carbon atoms	ignore between C and H Accept no double bond(s) / no multiple bond(s) Ignore answers that refer to numbers of hydrogens	1
c i	$\begin{array}{c} \text{H} \quad \text{H} \\   \quad   \\ \text{Br}-\text{C}-\text{C}-\text{Br} \\   \quad   \\ \text{H} \quad \text{H} \end{array}$	Accept Br atoms in any position provided one on each carbon	1
ii	C (the product of the reaction is colourless)		1
d	$\begin{array}{cccc} \text{H} & \text{CH}_3 & \text{H} & \text{H} \\   &   &   &   \\ \cdots-\text{C} & -\text{C}- & \text{C}- & \text{C}\cdots \\   &   &   &   \\ \text{H} & \text{H} & \text{H} & \text{CH}_3 \end{array}$	M1 for 4 × C AND 6 × H and 2 × CH <sub>3</sub> M2 for extension bonds and two CH <sub>3</sub> groups on alternate carbon atoms (can be both above or both below carbon chain) M2 DEP on M1 Do not penalise bonds to H of CH <sub>3</sub> Ignore brackets and subscripted n If any double bond shown, then 0/2	2
e	$\begin{array}{c} \text{F} \quad \quad \text{F} \\ \diagdown \quad / \\ \text{C} = \text{C} \\ / \quad \diagdown \\ \text{F} \quad \quad \text{F} \end{array}$	Reject any extension bonds Ignore bond angles Do not penalise more than one correct structure	1

Question number	Answer	Notes	Marks
8 f i	(polymer) breaks down / decomposes / decays  by bacteria / microbes / microorganisms	Do not penalise compound / object / molecule / substance in place of polymer Reject element in place of polymer Ignore rots / degrades / digests / disintegrate If reference to <u>not</u> breaking down etc, only M2 can be awarded Ignore naturally / enzymes	1  1
ii	inert / unreactive / OWTTE	Ignore do not react with named chemical Ignore references to bond strengths / bond breaking	1
<b>Total 10 marks</b>			

Question number	Answer	Notes	Marks
9 a	C (lithium reacts with water to form an alkali)		1
b	A (have the same number of outer shell electrons)		1
c	(similar) bubbles / fizzing / effervescence OR moves / darts / floats OR gets smaller / disappears potassium shows a flame / sparks / explodes OR potassium melts / forms ball	Accept gas given off /evolved/formed/produced Accept hydrogen <u>gas</u> Ignore identity of gas  Accept dissolves Accept reverse arguments for lithium	1      1
d	K <sub>2</sub> O  KCl	Accept K <sub>2</sub> O <sub>2</sub> and KO <sub>2</sub> Reject KO  If formula shown as <u>product</u> of an equation, ignore reactants and balancing Ignore coefficients	1   1
e	s l aq g		1
f	85 AND 87 calculated (even if not identified) (85 × 0.72) + (87 × 0.28) = 85.6	Accept 37+48 and 37+50 Correct final answer = 2 marks 85.5 or 85.56 = 1 mark No ECF from incorrect mass numbers Ignore units	1 1
<b>Total 9 marks</b>			

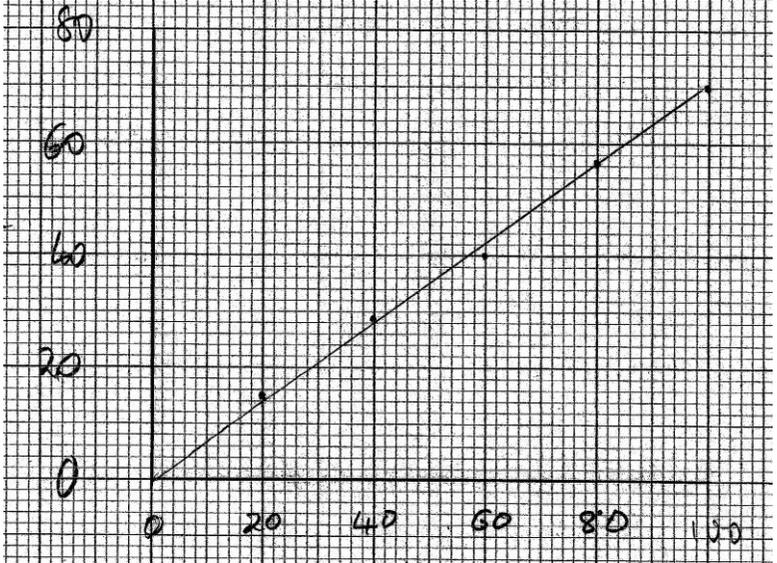


Question number	Answer	Notes	Marks
10 b i	B (the products are both elements)		1
	ii electrons on wrong side / should be on right	Accept + in front of electrons (should be —)	1
	/should be $- 2e^-$		
	2Br should be Br <sub>2</sub>	Accept product is shown as a bromine atom / should be shown as a bromine molecule Equation correctly rewritten scores both marks	1
	iii ions stop moving / ions not free to move	Ignore liquid becomes solid / no free ions	1
	OR		
	electrons stop moving (through wires)	Accept electric current in place of electrons Reject implication that electrons stop flowing through liquid	
<b>Total 9 marks</b>			

Question number	Answer	Notes	Marks
11 a	i pipette		1
	ii pink	Ignore purple	1
	colourless	Accept red	1
		Ignore clear	
		Ignore white	
		Award 1 mark for both colours correct in wrong order	
b	(after) 23.15		1
	(before) 1.40		1
	(added) 21.75		1
		CQ on before and after readings	
		Award 1 mark for both readings correct but in wrong order	
		All values must be to 2 dp	
		Penalise answers to other than 2 dp once only	
c	i ticks in columns 3 and 4		1
	ii $\frac{21.10 + 21.20}{2}$	CQ on any combination of ticked results	1
		If no results ticked, award M1 if only columns 3 and 4 averaged	
		If only 1 result ticked, then no marks can be awarded in (c)	
	21.15	CQ on results averaged - see separate table	1
		Answer should be to 2 dp, except that trailing zero not needed	
		Correct final answer without working scores 2	

Question number	Answer	Notes	Marks
11 d i	$0.300 \times \frac{200}{1000}$ 0.06(00) (mol)	Correct final answer scores 2 marks 60 scores 1 mark in di No marks for answers such as 0.6 / 6 / 600  Award 1 mark for 98 anywhere in iii ECF from incorrect $M_r$ Moles CQ on ii Must be 2 or more sig figs	1
clip ii	di $\div$ 2 / 0.03(00) (mol)		1
clip iii	$M_r = 98$ 2.94 (g)		1
			1
<b>Total 14 marks</b>			

Question number	Answer	Notes	Marks
12 a	mass / amount	Accept weight	1
	surface area / size / volume	Ignore number of marble chips Ignore length / width / height / thickness / shape / type Ignore temperature / purity / density	1
b	gas/carbon dioxide escapes / OWTTE	Ignore references to solid dissolving Ignore references to acid spray / vapour Do not penalise incorrectly named gas (eg hydrogen)	1
c	prevents loss of acid (spray)/liquid	Ignore references to evaporation / water vapour / spillage of liquid Reject references to stopping gases/marble chips escaping	1
d i	210 (s) some indication of mark on curve OR vertical line from 50% / horizontal line from 210 s	Mark M1 and M2 independently	1
	ii B (the loss of mass was greater than 1.0g)		1
e	1 ÷ 210	Accept any time value in range 200 - 210 Accept answer in range 0.004- 0.005 Accept any number of sig fig	1
	evaluation of M1 / 0.00476		1

Question number	Answer	Notes	Marks
12 f	 <p data-bbox="280 861 873 949">all five points plotted to nearest gridline straight line of best fit</p>	<p data-bbox="1075 845 1680 1093">Deduct 1 mark for each error up to max 2 Line need not be extrapolated to origin If line not extrapolated, it should go to the origin if extrapolated Must be drawn with a ruler <b>CQ on candidate's plotted points</b></p>	<p data-bbox="1758 861 1792 949">2 1</p>

Question number	Answer	Notes	Marks
12 g	<p>more particles (in a given volume)</p> <p>more collisions (between particles) / OWTTE</p> <p>per unit time / OWTTE</p>	<p>Accept ions Reject atoms / molecules Accept quantitative answer such as twice as many particles when concentration doubles</p> <p>more frequent collisions scores M2 and M3 Ignore greater chance/likelihood of collisions Accept reverse argument if clear that decreasing concentration is being considered MAX 1 if any reference to particles moving faster / having more energy</p>	<p>1</p> <p>1</p> <p>1</p>
<b>Total 15 marks</b>			

Pearson Education Limited. Registered company number 872828  
with its registered office at 80 Strand, London WC2R 0RL