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Mark Scheme (Results)

November 2025

Pearson Edexcel International GCSE in Chemistry
4CH1/2C

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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.

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<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>1 (a)</td><td>
<table>
<tr><th>Letter</th><th>titration</th><th>measures different volumes</th><th>evaporates solvent to produce crystals</th></tr>
<tr><td>P</td><td></td><td>✓</td><td></td></tr>
<tr><td>Q</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>R</td><td>✓</td><td></td><td></td></tr>
<tr><td>S</td><td></td><td></td><td>✓</td></tr>
<tr><td>T</td><td>✓</td><td></td><td></td></tr>
<tr><td>U</td><td></td><td></td><td></td></tr>
</table>
</td><td>extra ticks in any row lose 1 mark

any ticks in row U lose 1 mark</td><td>5</td></tr>
<tr><td>(b)</td><td>Q</td><td></td><td>1</td></tr>
<tr><td>(c)</td><td>(volumetric) pipette</td><td>REJECT dropping pipette</td><td>1</td></tr>
<tr><td></td><td></td><td></td><td>Total 7</td></tr>
</table>

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<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>2 (a)</td><td><table><tr><th>Halogen</th><th>State at 25 °C</th><th>Colour</th></tr><tr><td>fluorine</td><td>gas</td><td>pale yellow</td></tr><tr><td>chlorine</td><td>gas</td><td>(pale) green</td></tr><tr><td>bromine</td><td>liquid</td><td>brown</td></tr><tr><td>iodine</td><td>solid</td><td>dark grey</td></tr></table></td><td>ALLOW light green</td><td>3</td></tr>
<tr><td>(b)</td><td>solid</td><td></td><td>1</td></tr>
<tr><td>(c)</td><td>M1 42 x 79 + 58 x 81 OR 8016

M2 8016 ÷ 100 OR 80.16

M3 80.2</td><td>correct answer without working scores 3

ALLOW M2 ECF M1

ALLOW M3 ECF M2

ECF for M3 if all values in the question are used and the answer given to 3 sig.figs.</td><td>3</td></tr>
<tr><td>(d) (i)</td><td>(0.75 x 0.75 =) 0.5625</td><td>ALLOW 0.56 /0.563</td><td>1</td></tr>
<tr><td>(ii)</td><td>M1 (0.1875 x 2=) 0.375

M2 but need to x 2 to take into account that either Cl atom could be the 35 or 37 isotope OWTTE

OR

M1 Total probability is 1

M2 so remaining probability is 0.375</td><td>ALLOW ECF from (i)

ALLOW idea that shows two combinations of ^{35}Cl and ^{37}Cl isotopes to form a chlorine molecule with M_r of 72

ALLOW 0.38</td><td>2</td></tr>
</table>

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(e)	An explanation that links the following 5 points **M1** reactivity decreases down the group (from F/Cl to I) **M2** displacement reactions happen when more reactive halogen displaces a less reactive halogen **M3** from a solution/compound containing its halide (ions) **OR** **ALLOW** correct word or balanced chemical equation for **M2** and **M3** **M4** example of colour change in a displacement reaction **M5** example of reaction where displacement does not occur	 **ALLOW** fluorine is the most reactive element in Group 7 **ORA** **ALLOW** specific halogen displaces a less reactive halogen e.g. Chlorine/Cl is more reactive so it will displace bromine/Br (and iodine/I) **ALLOW** specific halide (ions) **ALLOW ORA** for **M2** and **M3**	5 **Total 15**

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Question number	Answer	Notes	Marks
3 (a) (i)	(hydrated) iron**(III)** oxide/ferric oxide	**ACCEPT** Fe_2O_3 **REJECT** iron oxide/FeO with incorrect oxidation state	1
(ii)	An explanation that links the following two points: **M1** paint acts as a barrier/(protective) layer **OWTTE** **M2** which prevents water/oxygen/air getting to the iron/reacting with iron	 **REJECT** galvanising /coating/covering/sacrificial protection	2
(b)	An explanation that links the following: **M1 (**high-carbon) steel is an alloy **M2** idea of a comparison of malleability between pure iron and (high-carbon) steel **M3** (pure) iron can be used in gates/railings/nails/wires/chains/cookware **M4 (**high-carbon) steel can be used in cutting tools/knives/blades/springs/bearings/hammers/rail tracks/car chassis **M5** (high carbon) steel has different-sized atoms /particles (which disrupt the structure/regular arrangement) **ORA** **M6** which means layers (of atoms/metal ions/particles) cannot slide over each other **ORA**	 **ALLOW** pure iron is more malleable than high-carbon steel **ORA** **ALLOW** car (bodies)/ship building/decorative metal works **IGNORE** cutlery/kitchen utensils **ALLOW** ideas of load-bearing applications/building reinforcement **ALLOW** steel has (both iron and carbon) atoms/particles which are of different sizes (and randomly arranged) **ALLOW** rows or sheets any mention of intermolecular forces/ionic bonds/covalent bonds/bond breaking max 5 marks	6
(c)	**M1** (amount of zinc =) 16 ÷ 65 **OR** 0.246 (mol) **M2** (volume of hydrogen = 0.246 x 24 =) 5.9 (dm^3)	correct answer without working scores 2 **ALLOW** ECF for incorrect A_r **ALLOW** answer correctly rounded to 1 sig.fig.	2

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(d)	(i)	Zn^{2+} /Zinc **ions** gain electrons	**ALLOW** Zn cations **REJECT** Zn/Zinc gains electrons	1
	(ii)	$4OH^- \rightarrow (1)O_2 + 2H_2O + 4e^-$	**ALLOW** multiples or fractions **IGNORE** state symbols even if incorrect	1
	(iii)	An explanation that links the following two points:		2
		M1 concentration of hydroxide ions/OH^- decreases	**ALLOW** H^+/hydrogen ions are formed **IGNORE** solution is acidic/H_2SO_4/acid is formed	
		M2 so universal indicator turns red	**ALLOW** orange **IGNORE** yellow **REJECT** pink	
				Total 15

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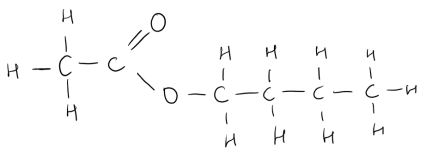
Question number	Answer	Notes	Marks
4 (a) (i)	ethene		1
(ii)	**M1** Pressure: 60 – 70 **atm/atmosphere(s)** (inclusive) **M2** Catalyst: Phosphoric acid	**ACCEPT** any pressure between 60 and 70 inclusive **ACCEPT** any correct alternative unit and quantity **ALLOW** sulfuric acid /H_2SO_4	2
(b) (i)	anaerobic/no O_2 /absence of air	**IGNORE** respiration	1
(ii)	**M1** enzymes become inactive below 30°C **M2** yeast cells/enzymes denature above 40°C	**ACCEPT** ideas of rate of reaction/fermentation being too slow below 30°C If **M1** and **M2** not scored, (yeast contains) **enzymes** need an optimum temperature scores 1 mark	2
(c) (i)	 **M1** for ester link **M2** for the rest of the molecule with all bonds shown	 **M2** dep on **M1**	2
(ii)	**M1** carboxylic acid ethanoic acid **M2** alcohol butanol	**ACCEPT** acetic acid **ACCEPT** butan-1-ol/ 1-butanol	2

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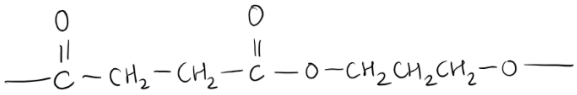
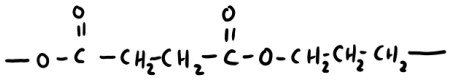
Question number	Answer	Notes	Marks
4 (d) (i)	condensation (polymerisation)		1
(ii)		**ACCEPT** 	2
	M1 ester link	**ALLOW** –COO–	
	M2 rest of the molecule correct with or without extension bonds	**M2** dep **M1** **ALLOW** C_2H_4 / C_3H_6 **IGNORE** brackets and n	
(iii)	water/H_2O		1
			Total 14

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Question number	Answer	Notes	Marks
5 (a)	**M1** anhydrous/white copper(II) sulfate/copper sulfate/$CuSO_4$ **M2** turns (from white to) blue	**ALLOW** anhydrous/blue cobalt(II) chloride/cobalt chloride **OR** cobalt(II) chloride paper **ALLOW** turns (from blue to) pink **M2** dep **M1** **IGNORE** water boils at 100°C	2
(b) (i)	**M1** starts at the origin **and** is steeper than the original curve **M2** levels off at 50 cm^3		2
(ii)	**M1** starts at the origin **and** is shallower than the original curve **M2** levels off at 50 cm^3	 ECF for **M2** from 5(b)(i)	2
(c)	A description that refers to five of the following seven points: **M1** add the same mass of the potassium iodide to the conical flask **M2** add the same volume of hydrogen peroxide **M3** keep the temperature constant **M4** start/set the timer **M5** record the volume of gas produced in a given time OR record the time for certain volume of gas to be evolved **M6** plot the results of the graph and calculate **OR** compare gradient (steepness) for each catalyst **M7** the more effective catalyst gives the fastest rate of reaction OWTTE	 **ALLOW** same surface area of catalyst	5
			Total 11

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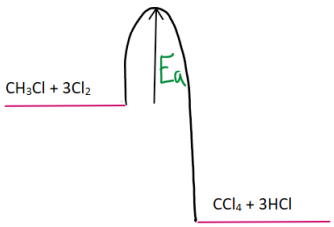
Question number	Answer	Notes	Marks
6 (a)	**M1** two horizontal lines in correct positions **M2** horizontal lines labelled correctly with formulae of reactants and products **M3** vertical line in correct position and labelled E_a  	**ALLOW** product line directly below reactants line **IGNORE** incorrect letter cases and subscripts/superscripts **ALLOW** ECF from M1 **REJECT** downwards pointing arrow/double-headed arrow /no arrowhead	3
(b)	**M1** $\sum$ bond energies on LHS = (3 x 414) + (1 x C-Cl) + (3 x 242) **OR** (1 x C-Cl) + 1968 (kJ/mol) **M2** $\sum$ bond energies on RHS = (4 x C–Cl) + (3 x 431) **OR** (4 x C–Cl) + 1293 (kJ/mol) **M3** (1 x C-Cl + 1968) – (4 x C–Cl + 1293) = –339 **M4** (**3** x C–Cl = 339 + 675) **OR** 1014 **M5** (C–Cl = 1014 ÷ 3 =) 338 (kJ/mol)	correct answer without working scores 5 **ALLOW** ECF calculation of Bonds broken – Bonds Made = -339 **ALLOW** ECF throughout	5
			Total 8