



Mark Scheme (Results)

January 2021

Pearson Edexcel International GCSE
In Chemistry (4CH1) Paper 2C

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
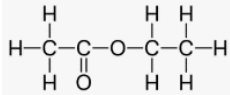
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General Marking Guidance

- 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.

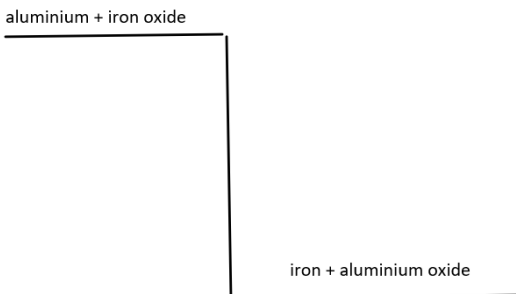
Question number	Answer	Notes	Marks
1 (a) (i)	<p>D D is the correct answer because protons occur in the nucleus and have a positive charge. A is not the correct answer since electrons occur in the energy levels. B is not the answer since ions do not occur in the nucleus. C is not the correct answer since neutrons have no charge.</p>		1
	(ii) 7		1
	(iii) lithium	ALLOW Li	1
(b) (i)	<p>M1 same number of protons</p> <p>M2 different number of neutrons</p>	<p>ALLOW same number of electrons</p> <p>IGNORE references to mass number and atomic number.</p>	2
			5 marks

Question number	Answer	Notes	Marks
2 (a) (i)	nitrogen	ALLOW N ₂ /N	1
	(ii) carbon dioxide	ALLOW CO ₂	1
	(iii) argon	ALLOW Ar	1
	(iv) carbon dioxide	ALLOW CO ₂	1
(b)	lighted splint (produces squeaky) pop		1
			5 marks

Question number	Answer	Notes	Marks
3 (a) (i)	Any two from: M1 volume of acid M2 temperature M3 mass / moles of magnesium M4 surface area / size of pieces of magnesium		2
	(ii) so as little gas as possible escapes	ALLOW so no gas escapes IGNORE references to accuracy REJECT references to gas getting in	1
(b) (i)	M1 $(69 + 70 + 71) \div 3$ M2 70s	Answer of 70 with or without working scores 2 Answer of 76 or 75.8 or 75.75 with or without working scores 1	2
	(ii) as the (number of) carbons increases the time (to produce 10 cm ³ of hydrogen) increases ORA		1
(c)	M1 ester linkage as a displayed structure  M2 rest of molecule correct as a fully displayed structure 		2
			8 marks

Question number	Answer	Notes	Marks
4 (a) (i)	$2 \text{Na(s)} + 2 \text{H}_2\text{O(l)} \rightarrow 2 \text{NaOH(aq)} + \text{H}_2\text{(g)}$ <p>M1 correct balancing numbers</p> <p>M2 (s) and (aq) for state symbols</p>	<p>ALLOW multiples or fractions.</p>	2
(ii)	hydroxide or OH ⁻	REJECT OH	1
(iii)	<p>Any three from:</p> <p>M1 the sodium moves (on the surface)</p> <p>M2 effervescence or bubbles (of gas)</p> <p>M3 (indicator or phenolphthalein or water) turns pink</p> <p>M4 the sodium gets smaller</p> <p>M5 the sodium melts or turns into a ball</p>	<p>ALLOW sodium floats</p> <p>IGNORE gas or hydrogen produced</p> <p>IGNORE initial colour of indicator</p> <p>ALLOW the sodium disappears / (appears to) dissolve</p>	3
(b)	<p>M1 electron configuration of sodium is 2,8,1 and electron configuration of potassium is 2,8,8,1</p> <p>M2 outer electron less attracted (to the nucleus of potassium)</p> <p>M3 therefore (outer shell electron) is more easily lost</p>	<p>ALLOW the outer shell is further from the nucleus</p> <p>ALLOW potassium has more shells</p> <p>ALLOW larger atom / larger atomic radius</p> <p>ALLOW reverse argument for sodium</p>	3
			9 marks

Question number	Answer	Notes	Marks
5 (a) (i)	M1 layers / rows (of atoms / ions) M2 can slide over one another	M2 is dependent on mention of layers / rows in M1	2
(ii)	M1 delocalised electrons M2 can move / can flow / are free to move (throughout the structure)	IGNORE references to charge or current IGNORE free electrons M2 dependent on mention of electrons in M1	2
(b)	aluminium is more reactive than carbon	ALLOW references to position in reactivity series e.g. aluminium is higher in reactivity series than carbon. ALLOW carbon is less reactive than aluminium	1
(c) (i)	M1 aluminium / Al ³⁺ ions are attracted to the negative electrode / cathode (because they are positively charged) M2 where they gain electrons (forming aluminium)	ALLOW Al ³⁺ + 3e ⁻ → Al IGNORE references to reduction	2
(ii)	2O ²⁻ → O ₂ + 4e ⁻	ALLOW 2O ²⁻ - 4e ⁻ → O ₂	1
(iii)	M1 electrodes are made of carbon M2 which reacts with / burns in oxygen		2

(d) (i)	iron oxide loses oxygen	IGNORE references to electrons	1
(ii)	 <p>M1 right hand line below left hand line</p> <p>M2 correct name / formula of both reactants</p> <p>M3 correct name / formula of both products</p>	<p>IGNORE horizontal axis drawn</p> <p>IGNORE activation energy if shown</p> <p>If only use words <i>reactants</i> (on left) and <i>products</i> (on right) award 1 mark from M2 and M3</p> <p>M2 and M3 can be scored from an endothermic diagram</p>	3
			14 marks

Question number	Answer	Notes	Marks
6 (a)	<p>M1 mix / stir / add (silver nitrate and copper (II) chloride)</p> <p>M2 filter (the silver chloride)</p> <p>M3 wash with (deionised / distilled) water</p> <p>M4 dry in a warm oven or dry with filter paper or leave / allow to dry (on a windowsill) or dry in a desiccator</p>	<p>IGNORE references to heating</p> <p>If evaporation is mentioned to form crystals max = 1</p>	4
(b)	<p>(i) M1 and M2 all points correctly plotted to \pm half a square</p> <p>(ii) M3 two straight lines of best fit which must meet at 3 cm and 6 cm³</p> <p>(iii) Any one from: the precipitate wasn't left to settle (for long enough) the tube was on a slant not enough / less than 3.0 cm³ of silver nitrate added</p> <p>(iv) all the copper [(II)] chloride has reacted</p>	<p>Deduct 1 mark for every incorrect point.</p> <p>ALLOW measured the height too early</p> <p>IGNORE references to human error unqualified</p> <p>ALLOW the silver nitrate is in excess / not all the silver nitrate has reacted</p>	<p>2</p> <p>1</p> <p>1</p> <p>1</p>

Question number	Answer	Notes	Marks
(c) (i)	Any one from: burette (volumetric) pipette	ALLOW measuring cylinder REJECT beaker	1
(ii)	Example calculation M1 moles of copper chloride = $(25 \times 0.50) \div 1000$ OR 0.0125 moles M2 moles of silver chloride = 0.0250 M3 mass of silver chloride = 3.59 g	ALLOW answer to M1 x 2 ALLOW answer to M1 or M2 x 143.5 ALLOW 2 or more significant figures Correct answer of 3.59 g scores 3 marks	3
(iii)	M1 $(0.744 \div 0.850) \times 100$ M2 87.5(%)	ALLOW 2 or more significant figures	2
			15 marks

Question number	Answer	Notes	Marks
7 (a)	<p>M1 crude oil is heated / vapourised</p> <p>M2 vapours / gases / compounds / hydrocarbons rise up the column</p> <p>M3 the column is hotter at the bottom than the top</p> <p>M4 vapours / compounds / hydrocarbons condense at their boiling point</p>	<p>ALLOW boiled</p> <p>ALLOW temperature gradient of the column</p> <p>ALLOW vapours / compounds / hydrocarbons / condense at different heights</p> <p>ALLOW the vapours / compounds / hydrocarbons / fractions have different boiling points.</p>	4
(b)	<p>M1 temperature of 600°C - 700°C</p> <p>M2 catalyst of silica / alumina</p>	<p>ALLOW aluminosilicates / zeolites / silicon dioxide / aluminium oxide</p> <p>IGNORE references to pressure</p>	2

Question number	Answer	Notes	Marks
(c) (i)	M1 nitrogen (from the air) reacts / combines with oxygen (from the air) M2 at high temperatures (in the car engine)	REJECT any implication that oxygen or nitrogen come from the fuel.	2
(ii)	Any one from: acid rain respiratory problems		1
(iii)	Example calculation M1 volume of carbon dioxide = $206\,000\text{ cm}^3 / 2.06 \times 10^5\text{ cm}^3 / 206\text{ dm}^3$ M2 volume of carbon dioxide per km = $51\,500\text{ cm}^3 / 5.15 \times 10^4\text{ cm}^3 / 51.5\text{ dm}^3$ M3 $(51\,500 \div 24\,000) = 2.15$ moles M4 M_r of carbon dioxide is 44 M5 mass of carbon dioxide per Km = 94.4 g	Division by 4 can happen in M1, M2, M3 or M5 ALLOW $M1 \div 4$ ALLOW M2 or $M1 \div 24\,000$ ALLOW 94 – 95 g ALLOW ecf from incorrect M_r Correct answer of 94 – 95 g scores 5 marks.	5
			14 marks

