Pearson Edexcel

Mark Scheme (Results)

January 2021

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

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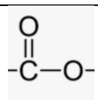
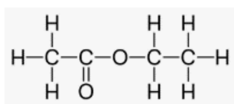
General Marking Guidance

- 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.

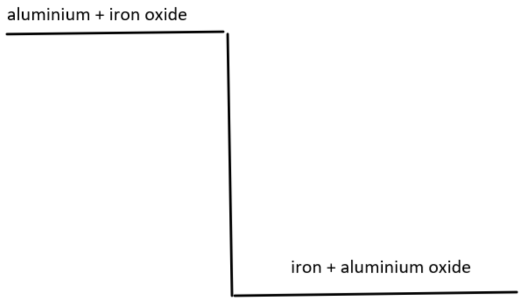
Question number	Answer	Notes	Marks
1 (a) (i)	**D** **D** is the correct answer because protons occur in the nucleus and have a positive charge. **A** is not the correct answer since electrons occur in the energy levels. **B** is not the answer since ions do not occur in the nucleus. **C** is not the correct answer since neutrons have no charge.		1
(ii)	7		1
(iii)	lithium	**ALLOW** Li	1
(b) (i)	M1 same number of protons M2 different number of neutrons	**ALLOW** same number of electrons **IGNORE** references to mass number and atomic number.	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) ÷ 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 Na**(s)** + 2 H_2O(l) → 2 $NaOH$**(aq)** + H_2(g) M1 correct balancing numbers M2 (s) and (aq) for state symbols	**ALLOW** multiples or fractions.	2
(ii)	hydroxide or OH^-	**REJECT** OH	1
(iii)	Any **three** from: M1 the sodium moves (on the surface) M2 effervescence or bubbles (of gas) M3 (indicator or phenolphthalein or water) turns pink M4 the sodium gets smaller M5 the sodium melts or turns into a ball	**ALLOW** sodium floats **IGNORE** gas or hydrogen produced **IGNORE** initial colour of indicator **ALLOW** the sodium disappears / (appears to) dissolve	3
(b)	M1 electron configuration of sodium is 2,8,1 and electron configuration of potassium is 2,8,8,1 M2 outer electron less attracted (to the nucleus of potassium) M3 therefore (outer shell electron) is more easily lost	**ALLOW** the outer shell is further from the nucleus **ALLOW** potassium has more shells **ALLOW** larger atom / larger atomic radius **ALLOW** reverse argument for sodium	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** $Al^{3+} + 3e^- \rightarrow Al$ **IGNORE** references to reduction	2
(ii)	$2O^{2-} \rightarrow O_2 + 4e^-$	**ALLOW** $2O^{2-} - 4e^- \rightarrow O_2$	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)	 M1 right hand line below left hand line M2 correct name / formula of **both** reactants M3 correct name / formula of **both** products	**IGNORE** horizontal axis drawn **IGNORE** activation energy if shown If only use words *reactants* (on left) and *products* (on right) award 1 mark from M2 and M3 M2 and M3 can be scored from an endothermic diagram	3
			14 marks

Question number			Answer	Notes	Marks
6	(a)		M1 mix / stir / add (silver nitrate and copper (II) chloride) M2 filter (the silver chloride) M3 wash with (deionised / distilled) water M4 dry in a warm oven **or** dry with filter paper **or** leave / allow to dry (on a windowsill) **or** dry in a desiccator	**IGNORE** references to heating If evaporation is mentioned to form crystals max = 1	4
	(b)	(i)	M1 and M2 all points correctly plotted to ± half a square	Deduct 1 mark for every incorrect point.	2
		(ii)	M3 two straight lines of best fit which must meet at 3 cm and 6 cm^3		1
		(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 cm^3 of silver nitrate added	**ALLOW** measured the height too early **IGNORE** references to human error unqualified	1
		(iv)	all the copper [(II)] chloride has reacted	**ALLOW** the silver nitrate is in excess / not all the silver nitrate has reacted	1

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 coper chloride = (25 x 0.50) ÷ 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 × 143.5 **ALLOW** 2 or more significant figures Correct answer of 3.59 g scores 3 marks	3
(iii)	M1 (0.744 ÷ 0.850) × 100 M2 87.5(%)	 **ALLOW** 2 or more significant figures	2
			15 marks

Question number	Answer	Notes	Marks
7 (a)	M1 crude oil is heated / vapourised M2 vapours / gases / compounds / hydrocarbons rise up the column M3 the column is hotter at the bottom than the top M4 vapours / compounds / hydrocarbons condense at their boiling point	**ALLOW** boiled **ALLOW** temperature gradient of the column **ALLOW** vapours / compounds / hydrocarbons / condense at different heights **ALLOW** the vapours / compounds / hydrocarbons / fractions have different boiling points.	4
(b)	M1 temperature of 600°C - 700°C M2 catalyst of silica / alumina	**ALLOW** aluminosilicates / zeolites / silicon dioxide / aluminium oxide **IGNORE** references to pressure	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 cm^3 / 2.06×10^5 cm^3 / 206 dm^3 M2 volume of carbon dioxide per km = 51 500 cm^3/ 5.15×10^4 cm^3 / 51.5 dm^3 M3 (51 500 ÷ 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 ÷ 4 **ALLOW** M2 or M1 ÷ 24 000 **ALLOW** 94 – 95 g **ALLOW** ecf from incorrect M_r Correct answer of 94 – 95 g scores 5 marks.	5
			14 marks

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