Mark Scheme (Results)

Summer 2024

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

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Summer 2024
Question Paper Log Number P75822A
Publications Code 4CH1_2C_2406_MS

General Marking Guidance

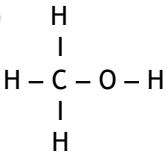
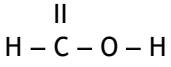
- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should 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)	sulfur	**ALLOW** S	1
(ii)	beryllium	**ALLOW** Be	1
(iii)	boron	**ALLOW** B	1
(iv)	2,8,4 / 2.8.4	**ACCEPT** diagram showing electron configuration	1
(b)	An explanation that links the following three points		3
	M1 the outer shell is further from the nucleus in sodium/sodium has more shells/sodium has a larger atomic radius ORA	**ALLOW** a sodium atom is larger than a lithium atom **ALLOW** Li 2,1 Na 2,8,1	
	M2 there is less attraction to the nucleus for the **outer** electron/**outer** shell in sodium ORA	**ALLOW** there is more shielding in sodium ORA	
	M3 so the (outer) **electron** is more easily lost ORA	**IGNORE** electron**s** (plural) in M1 and M2 but do not allow electron**s** in M3	
			Total 7

Question number	Answer	Notes	Marks
2 (a) (i)	**M1** oxygen **M2** water	**ALLOW** air /O_2 **ALLOW** moisture / water vapour /H_2O	2
(ii)	painting/oiling/coating with plastic/galvanising /electroplating /waxing /greasing	**REJECT** sacrificial protection	1
(b)	An explanation that links the following two points **M1** a more reactive metal is connected to/coated on the iron OWTTE **M2** the more reactive metal will react /oxidise /corrode instead of iron	 **ACCEPT** a suitable metal, e.g. zinc/magnesium /aluminium **IGNORE** an element **REJECT** a more reactive metal rusts instead of iron	2 **Total 5**

Question number	Answer	Notes	Marks
3 (a)	**M1** (A) refinery gases **M2** (F) bitumen		2
(b) (i)	aircraft fuel		1
(ii)	A description that refers to three of the following points		3
	M1 crude oil is heated/vaporised	**IGNORE** evaporated	
	M2 (the vapour) passes into/rises up the (fractionating) column / chamber OWTTE		
	M3 the kerosene /the fraction is tapped off/removed at its boiling point range /condenses and removed	**ALLOW** kerosene/the fraction is removed at the 3rd or 4th level	
(c) (i)	**M1** silica/alumina	**ALLOW** silicon dioxide/SiO_2 /aluminium oxide /Al_2O_3 /zeolites /aluminosilicates	2
	M2 any value or range between 600 and 700 (°C) inclusive		
(ii)	An explanation that links three of the following points		3
	M1 there is a surplus supply of / less demand for larger fractions /molecules/hydrocarbons **OR** there is not enough supply / greater demand for smaller fractions/molecules /hydrocarbons		
	M2 alkenes are produced which are needed to make polymers	**ALLOW** plastics / to make ethanol	
	M3 smaller fractions /alkanes /molecules /hydrocarbons are needed for petrol	**ALLOW** gasoline / fuel for cars	
			Total 11

Question number	Answer	Notes	Marks
4 (a) (i)	**M1** all points plotted correctly to the nearest + or – half a small square for KNO_3 **M2** all points plotted correctly to the nearest + or – half a small square for $NaNO_3$		2
(ii)	**M1** smooth curve of best fit for KNO_3 **M2** smooth curve of best fit for $NaNO_3$	If KNO_3 and $NaNO_3$ are not labelled or labelled incorrectly lose 1 mark if curves are correct but allow ECF for (c) and (d) if the curves are the wrong way round	2
(b)	temperature where their lines cross (expected value approximately 68 °C)		1
(c)	**M1** mass at 30 °C read from graph (expected value approximately 24 g) **M2** 4 x answer to **M1** (expected value approximately 96 g)		2
(d)	**M1** mass at 50 °C read from graph (expected value approximately 21 g) **M2** mass at 20 °C read from graph (expected value approximately 8 g) **M3** **M1 – M2** (expected value approximately 13 g)	Need to show working on the graph for **M1** and **M2** to score but allow **M3** for **M1 - M2**	3
			Total 10

Question number	Answer	Notes	Marks
5 (a)	Any two from **M1** same general formula **M2** same functional group **M3** similar chemical properties /characteristics **M4** trend in physical properties /characteristics **M5** consecutive members differ by a CH_2 group	 **IGNORE** same chemical properties accept any trend in specified physical property	2
(b) (i)	H_2SO_4		1
(ii)	**M1** (from) orange **M2** (to) green	must be in the correct order	2
(iii)	**M1** (methanol)  **M2** (methanoic acid) 	Penalise once only if O – H bond not shown and both structures correct	2
(c)	$CH_3OH + HCOOH \rightarrow HCOOCH_3 + H_2O$	**ALLOW** multiples **ALLOW** CH_3OOCH **IGNORE** state symbols even if incorrect **REJECT** CH_3COOH and $C_2H_4O_2$	1
(d) (i)	**A** (butyl ethanoate) B butyl methanoate is not the correct name of the ester $CH_3COOCH_2CH_2CH_2CH_3$ C ethyl butanoate is not the correct name of the ester $CH_3COOCH_2CH_2CH_2CH_3$ D methyl butanoate is not the correct name of the ester $CH_3COOCH_2CH_2CH_2CH_3$		1
(ii)	$C_6H_{12}O_2$	**ALLOW** symbols in any order	1
			Total 10

Question number	Answer	Notes	Marks
6 (a)	A description that refers to the following three points **M1** filter (the mixture) **M2** wash (the precipitate/solid/lead(II) bromide with distilled water) **M3** suitable drying method	 e.g. dry with filter paper /leave to dry/dry in a desiccator/dry in an oven **REJECT M3** if they attempt to crystallise the filtrate If any attempt to evaporate the solution allow MAX 1	3
(b) (i)	2(.0) x 0.025 = 0.05(0) (mol) **OR** $\frac{2(.0) \times 25}{1000}$ = 0.05(0) (mol)	**ACCEPT** 25 ÷ 1000 = 0.025 0.05 ÷ 0.025 = 2 All working must be shown to gain full marks	1
(ii)	**M1** (*n* $PbBr_2$) = 0.05(0) ÷ 2 = 0.025 **M2** 0.025 x 367 = 9.175 (g) **OR** **M1** 0.05 x 367 = 18.35 (g) **M2** 18.35 ÷ 2 = 9.175 (g)	**ALLOW** 2:1 = 0.05:0.025 **ACCEPT** 9.18/9.2/9 (g) **ACCEPT** 9.18/9.2/9 (g) All working must be shown to gain full marks	2
(c) (i)	An explanation that links the following three points **M1** when solid the ions are in fixed positions/in a lattice **M2** so there are no ions/electrons/charged particles free to move **M3 (**when molten) the ions are free to move so can conduct electricity/carry a current	 **IGNORE** carry charge **REJECT** solution for **M3** **REJECT** electrons moving /delocalised electrons for **M3**	3

	(ii)	An explanation that links the following two points **M1** graphite **M2** resistance to high temperature /has a high melting point	 **IGNORE** carbon **ALLOW** platinum **ALLOW** conducts electricity / doesn't react with product /is inert **M2** dependent on graphite /carbon /a transition metal	2
	(iii)	$Pb^{2+} + 2e^{(-)} \rightarrow Pb$	**ACCEPT** multiples **IGNORE** state symbols even if incorrect	1
(d)	(i)	brown vapour/gas/fumes	**ALLOW** red-brown vapour/gas/fumes **REJECT** orange/orange-brown/red alone	1
	(ii)	bromide (ions)/Br^- loses electrons	**ALLOW** electrons are lost **REJECT** bromine loses electrons	1
				Total 14

Question number	Answer	Notes	Marks
7 (a)	**M1** (electrostatic) attraction between nuclei (of both atoms) **M2** and a shared/bonding pair of electrons **OR** **M1** (electrostatic) attraction between a shared/bonding pair of electrons **M2** and nuclei (of both atoms)	nuclei must be plural nuclei must be plural	2
(b)	An explanation that links the following four points **M1** (in the organic solvent) litmus paper stays blue/has no change **M2** because there are no (H^+) ions/ the solution is not acidic /does not dissociate in an organic solvent **M3** (in the aqueous solution) litmus paper turns red **M4** because H^+ ions are formed/hydrochloric acid forms	 No **M1 or M2** if litmus paper turns red **REJECT M3** if litmus is bleached or turns white **M4** dep on litmus turning red initially	4
(c) (i)	**M1** reactants bond energy = 436 + 242 **OR** 678 (kJ) **M2** products bond energy = 2 x 431 **OR** 862 (kJ) **M3** − 184 (kJ/mol)	correct answer − 184 with or without working scores 3 (+)184 scores 2 **ALLOW** ecf on incorrect values on **M1** and/or **M2**	3
(ii)	**M1** show correct positions of horizontal lines and activation energy hump **M2** correct labelling of (reactants) H_2 + Cl_2 and (products) 2HCl **M3** vertical line in correct position labelled ΔH	**ALLOW** ecf if positive answer in (i) **M3 REJECT** arrow pointing down **ACCEPT** arrow pointing down or double headed arrow **REJECT** arrow pointing up	4

	M4 vertical line in correct position labelled Ea or activation energy	**ACCEPT** arrow pointing up or double headed arrow **REJECT** arrow pointing down	**Total 13**