



## Mark Scheme (Results)

November 2024

Pearson Edexcel International GCSE  
In Chemistry (4CH1) Paper 1C

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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)	from liquid to solid <b>freezing</b> from gas to liquid <b>condensing</b> from solid to gas <b>sublimation</b>	ALLOW condensation ALLOW subliming	3
(b) (i)	<b>6</b> circles similar size randomly arranged none touching	At least one circle in top/bottom of box	1
(ii)	A (the atoms move randomly in the gas state) B is not correct since atoms do not move randomly in the solid state C is not correct since atoms are not in a fixed position in the gas state D is not correct since atoms are not in a fixed position in the liquid state		1
(c)	$\text{H}_2\text{O}(\text{l}) \rightarrow \text{H}_2\text{O}(\text{s})$	ALLOW upper case/lower case	1
		Total = 6	

Question number	Answer	Notes	Marks
2 (a) (i)	oxygen	ALLOW O <sub>2</sub>	1
(ii)	nitrogen	ALLOW N <sub>2</sub>	1
(iii)	chlorine	ALLOW Cl <sub>2</sub>	1
(b)	M1 (hydrogen chloride) has (atoms of) two / different elements  M2 (chemically) bonded/joined / (chemically) combined together	ALLOW two different atoms	2
(c)	D (chlorine has the strongest forces of attraction between its molecules)  A is not the correct answer because covalent bonds are not broken when chlorine boils B is not the correct answer because covalent bonds do not occur between molecules C is not the correct answer because chlorine does not have ionic bonds		1
		Total = 6	

Question number	Answer	Notes	Marks
3 (a) (i)	M1 oxygen  M2 water	ALLOW air ALLOW O <sub>2</sub>  ALLOW moisture ALLOW H <sub>2</sub> O	2
(ii)	(hydrated) iron <u>(III)</u> oxide	ALLOW ferric oxide ALLOW Fe <sub>2</sub> O <sub>3</sub>	1
(b) (i)	M1 paint acts as a barrier / (protective) layer OWTTE  M2 which prevents water/oxygen/air getting to the iron/reacting with iron	NOT galvanising NOT coating/covering	2
(ii)	galvanising	ALLOW sacrificial protection	1
(iii)	M1 zinc is more reactive than iron OR zinc has a greater tendency to lose electrons  M2 zinc oxidises / forms zinc oxide/reacts before iron	ALLOW zinc reacts instead of iron NOT zinc reacts more rapidly/faster  REJECT references to zinc rusting REJECT zinc reacts with iron	2
			Total = 8

Question number	Answer	Notes	Marks
4 (a)	<p>M1 draw a line in pencil (just above the bottom of the paper)</p> <p>M2 put a spot of each ink on the line (before contact with solvent)</p> <p>M3 pour some solvent in the beaker</p> <p>M4 place the paper in the beaker so the spots are above the solvent</p> <p>M5 leave until the solvent has risen up the paper (nearly to the top)</p>	<p>ALLOW water for solvent</p> <p>ALLOW water for solvent</p> <p>ALL marks can be scored/supported from a labelled diagram</p>	5
(b) (i)	<p>M1 E</p> <p>M2 because it stayed on the start line/did not travel up paper</p>	<p>ALLOW didn't move/ Rf value =0</p> <p>M2 dep on M1</p>	2
(ii)	<p>M1 A and C</p> <p>M2 because they both (have a spot) at the same height OWTTE</p>	<p>ALLOW travelled same distance/same Rf value</p> <p>M2 dep on M1</p>	2
(iii)	<p>M1 measure the distance from the start line to the spot and the distance from the start line to the solvent front</p> <p>M2 distance moved by the spot ÷ distance moved by the solvent</p>	<p>M2 subsumes M1</p> <p>Allow 2 marks for a correct calculation method</p>	2
		Total = 11	

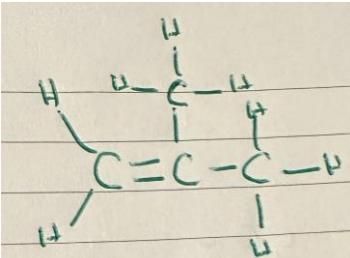
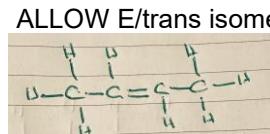
Question number	Answer	Notes	Marks
5 (a)	oxygen relights a glowing splint		1
(b)	M1 a catalyst provides an alternative pathway  M2 of lower activation energy	ALLOW alternative route	2
(c) (i)	A (conical) flask  B (gas) syringe		2
(ii)	M1 line from 4 minutes to the curved line  M2 38cm <sup>3</sup>	ALLOW values 37-39cm <sup>3</sup>	2
(iii)	M1 tangent drawn to the graph at 8 minutes touches curve once only  M2 measurements made from   M3 use measurements to calculate rate (y <sub>2</sub> -y <sub>1</sub> /x <sub>2</sub> -x <sub>1</sub> )(1sf or more)  M4 cm <sup>3</sup> /minute	ALLOW ecf for tangent drawn at other than 8 minutes  ALLOW cm <sup>3</sup> /min ALLOW cm <sup>3</sup> min <sup>-1</sup> ALLOW cm <sup>3</sup> /s ALLOW cm <sup>3</sup> s <sup>-1</sup>	4
	If NO tangent drawn or drawn incorrectly(M1 not awarded) then M3 awarded for 58-60/8 or 480 calculated correctly OR numbers from a  calculated correctly  AND M4 for cm <sup>3</sup> /minutes	ALLOW cm <sup>3</sup> /min ALLOW cm <sup>3</sup> min <sup>-1</sup> ALLOW cm <sup>3</sup> /s ALLOW cm <sup>3</sup> s <sup>-1</sup>	
		Total = 11	

Question number	Answer	Notes	Marks
6 (a) (i)	$\text{AlCl}_3$ $\text{ZnSO}_4$ $(\text{NH}_4)_3\text{N}$	ALLOW formula in reverse NOT molecular formula Penalise symbol letters/size of subscripts once only	3
(ii)	aluminium sulfate	ALLOW aluminium sulphate	1
(b)	M1 magnesium loses electrons  M2 chlorine gains electrons   M3 magnesium loses two electrons and two chlorines each gain one electron	ALLOW magnesium gives/transfers electrons to chlorine for M1,M2 NOT chloride gains electrons  M3 assumes M1,M2  ALLOW correct ionic equations	3
(c) (i)	M1 two electrons between each nitrogen and hydrogen atom  M2 two non-bonding electrons	M2 dep on M1	2
(ii)	M1 (electrostatic) forces of attraction between shared pair(s) of electrons  M2 and the nuclei	REJECT nucleus (must be plural) REJECT intermolecular forces for both marks	2
		Total = 11	

Question number	Answer	Notes	Marks
7 (a) (i)	<p>any <b>one</b> from:</p> <p>M1 to condense the water vapour</p> <p>M2 to ensure all the water collects in the tube (as a liquid)</p>	<p>ALLOW condense steam/condense gas NOT cools water</p> <p>NOT stops water evaporating</p>	1
(ii)	When the mass doesn't change / is constant/stops increasing	Accept: the last two results are the same Accept: balance reading stays the same	1
(b)	<p>M1 add anhydrous/white copper(II) sulfate/sulphate</p> <p>M2 which turns (from white to) blue</p>	<p>ALLOW anhydrous/white copper sulfate/sulphate</p> <p>ALLOW add anhydrous/blue cobalt chloride</p> <p>ALLOW which turns (from blue to) pink</p> <p>M2 dep on M1</p>	2
(c)	<p>M1 (mass of water) = 6.3g</p> <p>M2 (moles of <math>\text{MgSO}_4</math>) = 0.05</p> <p>M3 (moles of <math>\text{H}_2\text{O}</math>) 0.35</p> <p>M4 <math>x=7</math></p>	<p>Ecf for incorrect mass of water</p> <p>M1 can be awarded from moles of <math>\text{H}_2\text{O}</math> in M3</p> <p>Answer of 7 on its own scores 4 marks</p>	4
		Total = 8	

Question number	Answer	Notes	Marks
8 (a)	carbon dioxide/a gas escapes/is lost/released (through the cotton wool)	NOT carbon dioxide/gas is given off/produced NOT wrong named gas	1
(b)	M1 the concentration (of hydrochloric acid) is highest  M2 so there are more collisions per unit time	ALLOW there is a greater surface area of marble chips ALLOW greater amount of hydrochloric acid/reactants ALLOW more particles  ALLOW more frequent collisions  REJECT references to greater (kinetic) energy for both marks	2
(c)	the hydrochloric acid has been used up OWTTE	NOT acid is saturated  IGNORE acid is a limiting factor	1
(d) (i)	any two from:  (same) mass of marble chips  (same) surface area of marble chips  (same) concentration of hydrochloric acid  (same) volume of hydrochloric acid	ALLOW (same) amount of marble chips  ALLOW (same) size marble chips  NOT same amount of acid	2
(ii)	M1 rate of reaction increases  M2 particles have more energy OR more particles have energy greater than (or equal to) the activation energy  M3 so more successful collisions per unit time	ALLOW particles move faster  ALLOW more frequent successful collisions	3
		Total = 9	

Question number	Answer	Notes	Marks
9 (a)	aluminium is a better conductor (of heat) than glass (comparison needed)	REJECT insulation references	1
(b) (i)	carbon / soot/ C		1
(ii)	incomplete combustion occurs OR the supply of oxygen/air is limited		1
(c) (i)	M1 $100 \times 4.2 \times 50$ M2 21000(J)	ALLOW ecf for M2 if answer close to 20000J	2
(ii)	M1 21 kJ M2 $1.84 \div 46$ OR 0.04 moles M3 $21 \div 0.04$ OR 525 (kJ/mol) M4 -525 (kJ/mol)	ALLOW 20kJ ALLOW 21 $\div$ M2 ALLOW 500 (kJ/mol) if 20kJ used M4 is for the - sign. ALLOW ecf from M3	4
(d) (i)	5O <sub>2</sub>	ALLOW multiples if the rest of the balancing numbers have been multiplied	1
(ii)	M1 ( $M_r$ of butanol) 74 M2 (moles of butanol) $3.7 \div 74$ OR 0.05 M3 0.45 moles	ALLOW 3.7 $\div$ M1 if attempted $M_r$ shown ALLOW M2 $\times$ 9 Answer of 0.45 scores 3	3
		Total = 13	

Question number	Answer	Notes	Marks
10 (a) (i)	<p>any <b>one</b> from:</p> <p>M1 ethane is saturated</p> <p>M2 ethane has no double bonds</p> <p>M3 ethane has single bonds only</p>		1
(ii)	<p>M1 products <math>C_2H_5Br</math> and <math>HBr</math></p> <p>M2 <b>condition</b> ultra violet radiation / ultra violet light/UV</p>	<p>In either order</p> <p>ALLOW balanced equations with a polysubstituted halogenoalkane</p>	2
(iii)	orange/yellow/brown to colourless/decolourises	NOT red/red-brown	1
(b) (i)	<p>any <b>two</b> from:</p> <p>M1 same functional group</p> <p>M2 the same/similar chemical properties OR undergo same/similar chemical reactions</p> <p>M3 trend in physical properties</p> <p>M4 differ by <math>CH_2</math></p>	<p>NOT similar reactivity</p> <p>ALLOW a named physical property e.g. boiling point</p> <p>NOT similar physical properties</p>	2
(ii)	<p>M1 same molecular formula</p> <p>M2 different displayed/structural formulae</p>	<p>NOT same empirical/general formula</p> <p>ALLOW different structures/arrangements</p>	2
(iii)		<p>ALLOW E/trans isomer</p> 	1

<p>(c)</p>	<p>M1 chain length longer in poly(ethene)</p> <p>M2 polymer contains only single (covalent) bonds /no double bond</p> <p>M3 ethene is a gas and poly(ethene) is a solid</p>	<p>ALLOW monomer contains double C=C bonds</p> <p>ALLOW reactant/ethene unsaturated</p> <p>ALLOW product/polyethene saturated</p>	<p>3</p>
		<p>Total = 12</p>	

Question number	Answer	Notes	Marks
11 (a) (i)	$2\text{PbS} + 3\text{O}_2 \rightarrow 2\text{PbO} + 2\text{SO}_2$ M1 formulae of $\text{O}_2$ and $\text{SO}_2$ M2 rest of equation correctly balanced	M2 dep on M1 ALLOW multiples/fractions	2
(ii)	(sulfur dioxide causes) acid rain / breathing problems	ALLOW named breathing problems such as asthma ALLOW other effects of acid rain such as killing fish, damage to stonework, killing plants	1
(iii)	M1 (moles lead(II) oxide) = $892\,000\,000 \div 223$ OR 4 000 000 moles  M2 (moles of carbon dioxide) = 2 000 000  M3(mass of carbon dioxide) = 88 (tonnes)	ALLOW calculations done in megamoles throughout  ALLOW M1÷2  88 (tonnes) scores 3 marks	3
(iv)	any 5 from: lead(II) sulfide M1 giant ionic structure/lattice  M2 strong (ionic) bonds OR strong electrostatic forces (between oppositely charged) ions  M3 which take a lot of energy to break / overcome sulfur dioxide  M4 simple molecular/covalent structure  M5 weak intermolecular forces OR weak forces between molecules  M6 which take little energy to overcome	REJECT molecules/covalent bonds/ intermolecular forces for all three marks  M3 dep on M2  REJECT ions/ionic bonds for all 3 marks  ALLOW molecules NOT particles/atoms  NOT weak IMF between atoms  M6 dep on M5	5
(b)	M1 $90.7 \div 207$ and $9.30 \div 16$  M2 0.438 (moles of lead) and 0.581 (moles of	NOT atomic numbers  ALLOW $9.30 \div 32$ for ecf	4

	<p>oxygen)</p> <p>M3 ratio of moles = 1:1.33</p> <p>M4 empirical formula is <math>\text{Pb}_3\text{O}_4</math></p>	<p>Answer must be 2sf or more</p> <p>ALLOW 1.3</p> <p>ALLOW ecf from ratio shown to produce formula</p>	
		<p>Total = 15</p>	

