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 freezing from gas to liquid condensing from solid to gas sublimation	 ALLOW condensation ALLOW subliming	3
(b) (i)	**6** 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)	$H_2O(l) \rightarrow H_2O(s)$	ALLOW upper case/lower case	1
		Total = 6	

Question number	Answer	Notes	Marks
2 (a) (i)	oxygen	ALLOW O_2	1
(ii)	nitrogen	ALLOW N_2	1
(iii)	chlorine	ALLOW Cl_2	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	ALLOW air ALLOW O_2	2
	M2 water	ALLOW moisture ALLOW H_2O	
(ii)	(hydrated) iron **(III)** oxide	ALLOW ferric oxide ALLOW Fe_2O_3	1
(b) (i)	M1 paint acts as a barrier / (protective) layer OWTTE	NOT galvanising NOT coating/covering	2
	M2 which prevents water/oxygen/air getting to the iron/reacting with iron		
(ii)	galvanising	ALLOW sacrificial protection	1
(iii)	M1 zinc is more reactive than iron OR zinc has a greater tendency to lose electrons	ALLOW zinc reacts instead of iron NOT zinc reacts more rapidly/faster	2
	M2 zinc oxidises / forms zinc oxide/reacts before iron	REJECT references to zinc rusting REJECT zinc reacts with iron	
		Total = 8	

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

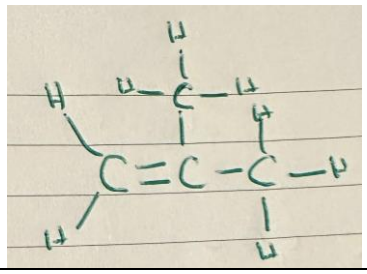
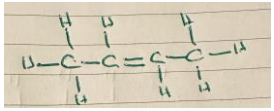
Question number	Answer	Notes	Marks
5 (a)	oxygen relights a glowing splint		1
(b)	M1 a catalyst provides an alternative pathway M2 of lower activation energy	ALLOW alternative route	2
(c) (i)	A (conical) flask B (gas) syringe		2
(ii)	M1 line from 4 minutes to the curved line M2 38cm^3	 ALLOW values 37-39cm^3	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 (y2-y1/x2-x1)(1sf or more) M4 cm^3/minute 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^3/minutes	 ALLOW ecf for tangent drawn at other than 8 minutes ALLOW cm^3/min ALLOW cm^{3}min^{-1} ALLOW cm^3/s ALLOW cm^{3}s^{-1} ALLOW cm^3/min ALLOW cm^{3}min^{-1} ALLOW cm^3/s ALLOW cm^{3}s^{-1}	4
		Total = 11	

Question number	Answer	Notes	Marks
6 (a) (i)	$AlCl_3$ $ZnSO_4$ $(NH_4)_3N$	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)	any **one** from: M1 to condense the water vapour M2 to ensure all the water collects in the tube (as a liquid)	 ALLOW condense steam/condense gas NOT cools water NOT stops water evaporating	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)	M1 add anhydrous/white copper(II) sulfate/sulphate M2 which turns (from white to) blue	ALLOW anhydrous/white copper sulfate/sulphate ALLOW add anhydrous/blue cobalt chloride ALLOW which turns (from blue to) pink M2 dep on M1	2
(c)	M1 (mass of water) = 6.3g M2 (moles of $MgSO_4$) = 0.05 M3 (moles of H_2O) 0.35 M4 x=7	Ecf for incorrect mass of water M1 can be awarded from moles of H_2O in M3 Answer of 7 on its own scores 4 marks	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 3
(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	
		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)	M1100×4.2×50 M2 21000(J)	 ALLOW ecf for M2 if answer close to 20000J	2
(ii)	M1 21 kJ M2 1.84÷46 OR 0.04 moles M3 21÷0.04 OR 525 (kJ/mol) M4 -525 (kJ/mol)	ALLOW 20kJ ALLOW 21÷M2 ALLOW 500 (kJ/mol) if 20kJ used M4 is for the – sign. ALLOW ecf from M3	4
(d) (i)	$5O_2$	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÷74 OR 0.05 M3 0.45 moles	 ALLOW 3.7÷M1 if attempted Mr shown ALLOW M2×9 Answer of 0.45 scores 3	3
		Total = 13	

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

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

Question number	Answer	Notes	Marks
11 (a) (i)	$2PbS + 3O_2 \rightarrow 2PbO + 2SO_2$ M1 formulae of O_2 and 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 ÷ 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÷207 and 9.30÷16 M2 0.438 (moles of lead) and 0.581 (moles of	NOT atomic numbers ALLOW 9.30÷32 for ecf	4

	oxygen) M3 ratio of moles = 1:1.33 M4 empirical formula is Pb_3O_4	Answer must be 2sf or more ALLOW 1.3 ALLOW ecf from ratio shown to produce formula	
		Total = 15	

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