Mark Scheme (Results)

Summer 2025

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

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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)	freezing		1
(ii)	evaporation		1
(iii)	sublimation		1
(b)	Any 3 from M1 (particles) are far apart M2 (particles) are randomly / irregularly arranged M3 (particles) have (almost) total freedom of movement /move freely M4 particles have high/higher energy M1 comment on spacing M2 comment on arrangement M3 comment on moving M4 comment on energy	 ALLOW no arrangement ALLOW random motion	3
			Total = 6

Question number	Answer	Notes	Marks
2 (a) (i)	water	ALLOW moisture /water vapour /steam	1
(ii)	(hydrated) iron**(III)** oxide	ALLOW ferric oxide /Fe_2O_3 If alternatives are present all must be correct	1
(b) (i)	M1 (paint) acts as a barrier/coated with paint /protective layer M2 which prevents oxygen/air/water getting to the iron		2 1
(ii)	galvanising /galvanisation	ALLOW sacrificial protection	
(iii)	M1 zinc is **more** reactive (than iron) M2 zinc oxidises /zinc reacts / zinc loses electrons in preference to iron /zinc oxide forms /zinc corrodes /zinc is a reducing agent	ALLOW zinc is higher in the reactivity series REJECT zinc rusts for M2	2
			Total = 7

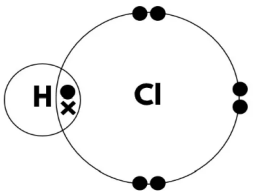
Question number	Answer	Notes	Marks
3 (a)	M1 dissolving /dissolves /dissolution? M2 diffusion /diffuses	can be either way round	2
(b)	M1 particles **move** faster M2 so particles **collide** and react after a shorter period of time	ALLOW particles have **more** kinetic energy ALLOW diffuse **faster** ALLOW **more** frequent collisions	2
(c) (i)	3 /three		1
(ii)	$2+$ / Cu^{2+}	ALLOW +2 /Cu^{+2}	1
			Total = 6

Question number	Answer	Notes	Marks
4 (a)	<table><tr><th>Relative mass</th><th>Relative charge</th></tr><tr><td>1</td><td>0</td></tr><tr><td>1</td><td>+1</td></tr><tr><td>0.0005 to 0.0006 or 1/1800 to 1/2000</td><td>-1</td></tr></table>	REJECT any sign for the relative mass	3
(b) (i)	A		1
(ii)	D		1
(iii)	C		1
(c)	similarity number of protons OR number of electrons /electron configuration /3 protons difference number of neutrons /3 or 4 neutrons	ALLOW same atomic number and different mass number for 1 mark if no other mark awarded	2
(d)	M1 ((79×24)+(10×25)+(26×11))÷100 M2 24.32 M3 24.3	ALLOW ecf from M2 to 1dp 24.3 scores 3 marks	3
			Total = 11

Question number	Answer	Notes	Marks
5 (a)	<table><tr><th>Colour</th><th>Physical state at room temperature</th></tr><tr><td>pale yellow</td><td>gas</td></tr><tr><td>pale green</td><td>gas</td></tr><tr><td>brown /orange-brown /red-brown</td><td>liquid</td></tr><tr><td>dark grey</td><td>solid</td></tr><tr><td>black</td><td>solid</td></tr></table>	do not accept red alone	3
(b) (i)	$Cl_2 + 2NaBr \rightarrow Br_2 + 2NaCl$ M1 all formulae correct M2 equation correctly balanced	IGNORE state symbols even if incorrect M2 dep on M1	2
(ii)	M1 no reaction M2 bromi**n**e is less reactive than chlori**n**e / chlori**n**e is more reactive than bromi**n**e	ALLOW bromine is not as good an oxidising agent as chlorine do not allow bromi**d**e is less reactive than chlorine OR chloride is more reactive than bromine for M2 M2 dep on M1	2
(iii)	M1 astati**d**e (ions)/At^- are oxidised/reducing agent as they lose electrons M2 bromi**n**e (molecules)/Br_2 are reduced /oxidising agent as they gain electrons	ALLOW astati**d**e (ions) are oxidised as their oxidation state increases do not allow astati**n**e is oxidised OR bromi**d**e is reduced ALLOW bromi**n**e is reduced as its oxidation state deceases ALLOW astati**d**e (ions) are oxidised and bromi**n**e is reduced for 1 mark ALLOW astati**d**e loses electrons and bromi**n**e gains electrons for 1 mark	2
			Total = 9

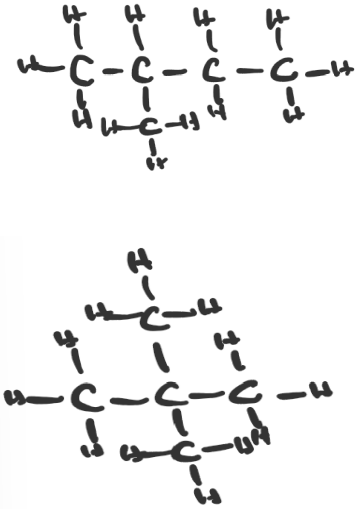
Question number	Answer	Notes	Marks
6 (a)	**D (as a proton donor)** A is not the correct answer as acids are not electron acceptors B is not the correct answer as acids are not electron donors C is not the correct answer as acids are not proton acceptors		1
(b)	effervescence / bubbles / fizzing / a colourless solution forms /magnesium dissolves / magnesium gets smaller/gets warm	IGNORE gas produced	1
(c)	to ensure all the (hydrochloric) acid has reacted	ALLOW acid used up for reacted ALLOW to ensure it has neutralised	1
(d)	A description connecting any 5 of the following: M1 filter (the excess magnesium) M2 heat M3 until crystals first start to form M4 allow to cool and crystallise M5 pour off excess liquid M6 leave in a warm place to dry	 ALLOW heat to evaporate some of the water ALLOW heat until a saturated solution forms ALLOW filter / decant IGNORE washing the crystals ALLOW dry with a paper towel OR in a warm oven OR dry in a desiccator OR leave to dry If sample is heated to dryness award M1 and M2 only	5
			Total = 8

Question number	Answer	Notes	Marks
7 (a)	M1 (moles of $CaCO_3$) = 5÷100 **OR** 0.05 mol		3
	M2 (mass of CO_2) = 0.05×44 **OR** 2.2g	ecf for M1 if moles attempted	
	M3 (reading on balance) 122.2-2.2 = 120.00g	ecf for M2 120 g scores 2 marks	
(b) (i)	All points plotted correctly ± half a square		1
(ii)	Curve of best fit joining all the points		1
(iii)	M1 tangent drawn at 2 minutes	If no tangent drawn 1 mark for M3 only	3
	M2 gradient of tangent		
	M3 g/minute/g minute^{-1}/g/min/g min^{-1}/gram/minute	do not allow g/m for M3	
(iv)	An explanation that links any 2 pairs of the following points		4
	Pair 1		
	M1 (the curve) is steep(est) at the start	ALLOW the gradient is greater at the start	
	M2 because the reaction is fast(est) at the start / because the (acid) concentration is high(est) /more calcium carbonate /more chips		
	Pair 2		
	M3 (the curve) becomes less steep	ALLOW the gradient decreases	
	M4 because the reaction slows down / because the acid becomes more dilute /less calcium carbonate /less chips		
	Pair 3		
	M5 the curve levels off / the graph plateaus	ALLOW the gradient becomes zero/0/flat /horizontal/constant	
	M6 because all the calcium carbonate /chips have reacted /used up		
(c)	M1 the rate of reaction increases	If **more** energy is implied or **move** faster lose 1 mark	3
	M2 because the powder has a greater surface **area**		
	M3 so there are more collisions per unit time	ALLOW more frequent collisions /collide more often	
			Total = 15

Question number	Answer	Notes	Marks
8 (a)	M1 attraction between nuclei M2 and shared pair(s) of electrons OR M1 attraction between shared pair(s) of electrons M2 and nuclei	nucleus must be plural nucleus must be plural REJECT intermolecular forces for both marks	2
(b) (i)	 M1 one shared pair of electrons M2 rest of the molecule correct	ALLOW any combination of dots and crosses ALLOW any inner shells of chlorine as long as they are correct	2
(ii)	M1 intermolecular forces of attraction are weak M2 which require little energy to overcome	ALLOW weak forces between molecules M2 dep on M1 do not allow **less** energy	2
(c) (i)	any one from: oxygen/it is a smaller atom than silicon oxygen/it has two shells, silicon has three shells each silicon atom is bonded to four oxygen atoms each oxygen atom is bonded to two silicon atoms		1
(ii)	silicon dioxide/SiO_2 is acidic and calcium oxide/CaO is basic	ALLOW an acid base reaction ALLOW one is an acid, one is a base REJECT calcium oxide is an alkali	1

(iii)	an explanation linking any 5 of the following points: NB do not credit high melting point as in the question M1 giant (covalent) structure / lattice M2 covalent bonds are **strong** M3 which requires a lot of energy to break the (covalent) bonds M4 3D / tetrahedral structure M5 every silicon atom makes 4 bonds / 4 pairs of electrons shared M6 no layers / atoms cannot slide over each other	 ALLOW **strong** attraction between shared pairs of electrons and nuclei M3 being dep on covalent do not allow **more** energy Lose 1 mark if they mention intermolecular forces or ionic bonding	5
			Total = 13

Question number	Answer	Notes	Marks
9 (a)	alkane(s)	not alk**e**ne(s)	1
(b)	M1 when sulfur (impurity in fuels) burns /combusts M2 sulfur dioxide / SO_2 forms M3 which dissolves / reacts with (rain) water	ALLOW sulfur reacts with oxygen do not allow acid rain alone as this is in the question IGNORE mention of nitrogen and NO_2 and carbon dioxide M3 dep on M1 or M2	3
(c) (i)	temperature 600-700°C catalyst alumina/silica/aluminosilicates/zeolites /Al_2O_3 /SiO_2		2
(ii)	M1 long-chain alkanes/hydrocarbons have lower demand or are less useful M2 (cracking produces) shorter alkanes that are more flammable / more useful as fuels or petrol or gasoline	ALLOW short chain hydrocarbons/alkanes are more useful/higher demand	3

	M3 (cracking produces) alkenes that can be used to make polymers /alcohols		
(d) (i)	M1 same molecular formula	ALLOW same number of carbons and hydrogens	2
	M2 different structural/displayed formulae	ALLOW different of arrangement of atoms	2
(ii)			
			Total = 13

Question number	Answer	Notes	Marks
10 (a) (i)	Any two of the following		2
	M1 use a polystyrene cup	ALLOW use a beaker with a lid ALLOW any piece of apparatus which is better insulated	
	M2 less **heat** will be lost		
	M3 leave to reach a steady temperature to record it		
(ii)	the zinc/powder/it is in excess		1
(iii)	blue to colourless		1
(b) (i)	M1 $\Delta T = 30.1(^{\circ}C)$		3
	M2 $25 \times 4.2 \times 30.1$	ALLOW ecf from M1	

	M3 3160.5(J)	ALLOW any number of significant figures from 2	
(ii)	M1 (moles of $CuSO_4$) 6.38÷159.5 **OR** 0.04 mol		4
	M2 3800÷0.04 **OR** 95 000	ALLOW ecf from M1	
	M3 division by 1000 = 95 (kJ)	ALLOW ecf from M2	
	M4 −95 kJ/mol	correct answer -95 scores 4 ecf -79 scores 3 (using the energy change from (b)(i)	
			Total = 11

Question number	Answer	Notes	Marks
11 (a)	sodium ions		5
	M1 do a flame test	ALLOW any description of a flame test	
	M2 yellow / orange flame		
	sulfate ions		
	M3 (make a solution and) add hydrochloric acid	ALLOW HCl / nitric acid / HNO_3 REJECT sulfuric acid	
	M4 add barium chloride solution	ALLOW $BaCl_2$ / barium nitrate / $Ba(NO_3)_2$	
	M5 white precipitate	M5 dep on M4	
(b) (i)	the last two results are the same	ALLOW mass is constant ALLOW heat to constant mass	1
(ii)	1.42 g		1
(iii)	1.80 g		1

(iv)	M1 1.42÷142 **OR** 0.01 M2 1.8÷18 **OR** 0.10 M3 0.10÷0.01=10	Answer of 10 or $Na_2SO_4.10H_2O$ scores 3	3
			Total = 11

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