



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
(ii)	galvanising / galvanisation	ALLOW sacrificial protection	1
(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

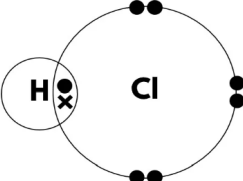
Question number	Answer	Notes	Marks
3 (a)	M1 dissolving /dissolves /dissolution? M2 diffusion /diffuses	can be either way round	2
(b)	M1 particles move faster M2 so particles collide and react after a shorter period of time	ALLOW particles have more kinetic energy ALLOW diffuse faster ALLOW more frequent 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)			REJECT any sign for the relative mass	3
	Relative mass	Relative charge		
	1	0		
	1	+1		
	0.0005 to 0.0006 or 1/1800 to 1/2000	-1		
(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

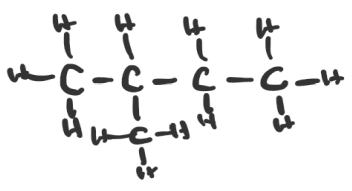
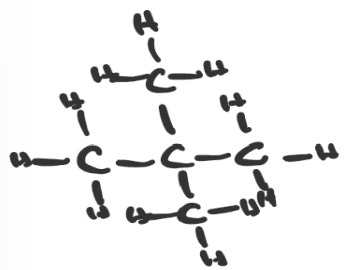
Question number	Answer	Notes	Marks												
5 (a)	<table><tr><td>Colour</td><td>Physical state at room temperature</td></tr><tr><td>pale yellow</td><td>gas</td></tr><tr><td>pale green</td><td>gas</td></tr><tr><td>brown /orange-brown /red-brown</td><td>liquid</td></tr><tr><td>dark grey</td><td>solid</td></tr><tr><td>black</td><td>solid</td></tr></table>	Colour	Physical state at room temperature	pale yellow	gas	pale green	gas	brown /orange-brown /red-brown	liquid	dark grey	solid	black	solid	do not accept red alone	3
Colour	Physical state at room temperature														
pale yellow	gas														
pale green	gas														
brown /orange-brown /red-brown	liquid														
dark grey	solid														
black	solid														
(b) (i)	$\text{Cl}_2 + 2\text{NaBr} \rightarrow \text{Br}_2 + 2\text{NaCl}$ M1 all formulae correct M2 equation correctly balanced	IGNORE state symbols even if incorrect M2 dep on M1	2												
(ii)	M1 no reaction M2 bromine is less reactive than chlorine / chlorine is more reactive than bromine	ALLOW bromine is not as good an oxidising agent as chlorine do not allow bromide is less reactive than chlorine OR chloride is more reactive than bromine for M2 M2 dep on M1	2												
(iii)	M1 astatide (ions)/At ⁻ are oxidised/reducing agent as they lose electrons M2 bromine (molecules)/Br ₂ are reduced /oxidising agent as they gain electrons	ALLOW astatide (ions) are oxidised as their oxidation state increases do not allow astatine is oxidised OR bromide is reduced ALLOW bromine is reduced as its oxidation state decreases ALLOW astatide (ions) are oxidised and bromine is reduced for 1 mark ALLOW astatide loses electrons and bromine gains electrons for 1 mark	2												
			Total = 9												

Question number	Answer	Notes	Marks
6 (a)	<p>D (as a proton donor)</p> <p>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</p>		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	<p>ALLOW acid used up for reacted</p> <p>ALLOW to ensure it has neutralised</p>	1
(d)	<p>A description connecting any 5 of the following:</p> <p>M1 filter (the excess magnesium)</p> <p>M2 heat</p> <p>M3 until crystals first start to form</p> <p>M4 allow to cool and crystallise</p> <p>M5 pour off excess liquid</p> <p>M6 leave in a warm place to dry</p>	<p>ALLOW heat to evaporate some of the water</p> <p>ALLOW heat until a saturated solution forms</p> <p>ALLOW filter / decant</p> <p>IGNORE washing the crystals</p> <p>ALLOW dry with a paper towel OR in a warm oven OR dry in a desiccator OR leave to dry</p> <p>If sample is heated to dryness award M1 and M2 only</p>	5
			Total = 8

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

Question number	Answer	Notes	Marks
8 (a)	<p>M1 attraction between nuclei</p> <p>M2 and shared pair(s) of electrons</p> <p>OR</p> <p>M1 attraction between shared pair(s) of electrons</p> <p>M2 and nuclei</p>	<p>nucleus must be plural</p> <p>nucleus must be plural</p> <p>REJECT intermolecular forces for both marks</p>	2
(b) (i)	 <p>M1 one shared pair of electrons</p> <p>M2 rest of the molecule correct</p>	<p>ALLOW any combination of dots and crosses</p> <p>ALLOW any inner shells of chlorine as long as they are correct</p>	2
(ii)	<p>M1 intermolecular forces of attraction are weak</p> <p>M2 which require little energy to overcome</p>	<p>ALLOW weak forces between molecules</p> <p>M2 dep on M1</p> <p>do not allow less energy</p>	2
(c) (i)	<p>any one from:</p> <p>oxygen/it is a smaller atom than silicon</p> <p>oxygen/it has two shells, silicon has three shells</p> <p>each silicon atom is bonded to four oxygen atoms</p> <p>each oxygen atom is bonded to two silicon atoms</p>		1
(ii)	<p>silicon dioxide/SiO₂ is acidic and calcium oxide/CaO is basic</p>	<p>ALLOW an acid base reaction</p> <p>ALLOW one is an acid, one is a base</p> <p>REJECT calcium oxide is an alkali</p>	1

(iii)	<p>an explanation linking any 5 of the following points:</p> <p>NB do not credit high melting point as in the question</p> <p>M1 giant (covalent) structure / lattice</p> <p>M2 covalent bonds are strong</p> <p>M3 which requires a lot of energy to break the (covalent) bonds</p> <p>M4 3D / tetrahedral structure</p> <p>M5 every silicon atom makes 4 bonds / 4 pairs of electrons shared</p> <p>M6 no layers / atoms cannot slide over each other</p>	<p>ALLOW strong attraction between shared pairs of electrons and nuclei</p> <p>M3 being dep on covalent</p> <p>do not allow more energy</p> <p>Lose 1 mark if they mention intermolecular forces or ionic bonding</p>	5
			Total = 13
Question number	Answer	Notes	Marks
9 (a)	alkane(s)	not alkene(s)	1
(b)	<p>M1 when sulfur (impurity in fuels) burns /combusts</p> <p>M2 sulfur dioxide / SO₂ forms</p> <p>M3 which dissolves / reacts with (rain) water</p>	<p>ALLOW sulfur reacts with oxygen</p> <p>do not allow acid rain alone as this is in the question</p> <p>IGNORE mention of nitrogen and NO₂ and carbon dioxide</p> <p>M3 dep on M1 or M2</p>	3
(c) (i)	<p>temperature 600-700°C</p> <p>catalyst alumina/silica/aluminosilicates/zeolites / Al₂O₃ / SiO₂</p>		2
(ii)	<p>M1 long-chain alkanes/hydrocarbons have lower demand or are less useful</p> <p>M2 (cracking produces) shorter alkanes that are more flammable / more useful as fuels or petrol or gasoline</p>	<p>ALLOW short chain hydrocarbons/alkanes are more useful/higher demand</p>	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
	(ii)	M2 different structural/displayed formulae  	ALLOW different of arrangement of atoms	2
				Total = 13

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

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

Question number	Answer	Notes	Marks
11 (a)	sodium ions M1 do a flame test M2 yellow / orange flame sulfate ions M3 (make a solution and) add hydrochloric acid M4 add barium chloride solution M5 white precipitate	ALLOW any description of a flame test ALLOW HCl / nitric acid / HNO_3 REJECT sulfuric acid ALLOW BaCl_2 / barium nitrate / $\text{Ba}(\text{NO}_3)_2$ M5 dep on M4	5
(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 $1.42 \div 142$ OR 0.01 M2 $1.8 \div 18$ OR 0.10 M3 $0.10 \div 0.01 = 10$	 Answer of 10 or $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$ scores 3	3
			Total = 11

