GradeMax

Mark Scheme (Results)

Summer 2026

Pearson Edexcel International GCSE in Chemistry

4CH1/1CR

GradeMax

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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)	neutron		1
(b)	15	**ALLOW** fifteen	1
(c)	**M1** (group) 5 **M2** (period) 2		2
(d)	same number of protons and electrons **OR** each atom has 7 protons and 7 electrons		1
(e) i	nitrogen	**ALLOW** N	1
ii	3-	**ALLOW** -3	1
			Total for question 1 = 7

Question number	Answer	Notes	Marks
2 (a)	Oxygen Water	**ALLOW** air **ALLOW** moisture/water vapour/steam answer in any order/correct formulae	2
(b) (i)	any one from magnesium/Mg aluminium/Al zinc/Zn		1
(ii)	A lighted/burning/flame splint pops	**REJECT** a glowing splint **IGNORE** squeaky pop test alone	1
(c)	**D (basic and giant)** A is not correct as metals do not form acidic oxides B is not correct as iron(III) oxide does not have a simple structure C is not correct as metals do not form acidic oxides		1
			Total for question 2 = 5

Question number	Answer	Notes	Marks
3 (a) (i)	a description including any three of the following points **M1** pour (some) solvent into a beaker / chromatography tank **M2** (place paper in the solvent/beaker) with the food colourings/spots/(samples of) A, B, C, D are above the level of the solvent OWTTE **M3** leave (the paper) until solvent reaches the level shown on the diagram/almost reaches top of paper/when spots reach the level shown on the diagram OWTTE **M4** (take the paper out and) leave it to dry	 **ALLOW** any named solvent **ALLOW** with start/pencil/base line above solvent **ALLOW** draw line at the level reached/travelled by solvent **IGNORE** any reference to spot travelling/ any description of the R_f value calculation All marks can be scored /supported from a labelled diagram	3
(ii)	a description containing any two of the following points **M1** (food colouring) A contains two dyes **M2** (food colouring) A contains (the dye in food colouring) B **M3** (food colouring) A contains another dye that is not in any other food colouring (C/D)	**ACCEPT** compounds/solutes for dyes **ALLOW** components/ substances/chemicals for dyes **IGNORE** (food colouring) A is a mixture/ reference to purity/solubility **REJECT** inks/elements for M1 only ECF for **M2** and **M3**	2
(iii)	use a different solvent OWTTE	**ALLOW** any named solvent **ALLOW** thin-layer chromatography **IGNORE** temperature	1

(b)	**M1** distance moved by the dye **AND** distance moved by the solvent **M2** distance moved by the dye ÷ distance moved by the solvent **M3** 0.75 – 0.80	answer in the range of 0.75 – 0.80 scores 3 **ALLOW** 4.7 – 4.9 (cm) **AND** 6.1– 6.3 (cm) ECF from **M1** ECF from **M2** for a correct calculation method only answer to 2 SF or more	3
			Total for question 3 = 9

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>4 (a)</td><td>
<table>
<tr><th>Process</th><th>Name of change</th></tr>
<tr><td>water changes into ice</td><td>freezing</td></tr>
<tr><td>solid iodine changes directly into a vapour</td><td>sublimation</td></tr>
<tr><td>sodium chloride crystals stirred in hot water</td><td>dissolving</td></tr>
</table>
</td><td></td><td>3</td></tr>
<tr><td>(b)</td><td>M1 the particles/molecules have more (kinetic) energy

M2 so can overcome / break the (intermolecular) forces/forces (between molecules)</td><td>IGNORE hot water has more (kinetic) energy
ALLOW particles/molecules move faster
IGNORE vibrate more

ALLOW so can break the bonds (between molecules) OR to break away from one another OR to escape more easily

IGNORE references to collisions, activation energy or rate of reaction</td><td>2</td></tr>
<tr><td>(c)</td><td>M1 measure the melting point

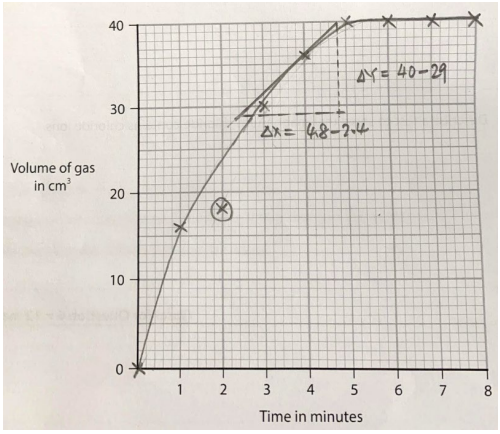
M2 the pure solid has a sharp/definite/fixed melting point

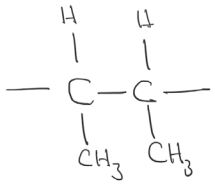
M3 the mixture/impure solid melts over a range of temperatures</td><td>ALLOW measuring freezing point
IGNORE reference to boiling point

ALLOW the mixture has a lower melting point/a pure substance has a higher melting point</td><td>3</td></tr>
<tr><td colspan="4">Total for question 4 = 8</td></tr>
</table>

Question number	Answer	Notes	Marks
5 (a)	argon carbon dioxide ethene nitrogen		4
(b) (i)	they both have full outer shells (of electrons)	**ALLOW** they do not need to lose or gain electrons **IGNORE** 8 electrons alone	1
(ii)	the volume of a gas changes with temperature/ gas expands when hot/heated/gas shrinks when cooled OWTTE	**ALLOW** to allow the steam to condense	1
(iii)	hydrogen is flammable/explosive	**IGNORE** temperature control	1
(iv)	**M1** (volume of hydrogen) 157.0–106.7 OR 50.3 cm^3 **M2** (50.3÷157.0) × 100 OR 32.038% **M3** 32.0(%) **OR** **M1** (1-(106.7 ÷157.0) =) 0.32038 **M2** 0.32038 x 100 **M3** 32.0(%)	correct answer to 1dp scores 3 ECF for **M2** and **M3** 47.1(%) scores 2 if **M1** scored	3
(v)	**M1** copper(II) oxide is reduced **OR** copper(II) oxide loses oxygen **OR** Cu^{2+} /copper ion gains electrons **M2** hydrogen is oxidised **OR** hydrogen gains oxygen **OR** H_2/hydrogen loses electrons	**REJECT** copper alone	2
			Total for question 5 = 12

Question number	Answer	Notes	Marks
6 (a) (i)	<table><tr><th></th><th>NH_4^+</th><th>Mg^{2+}</th><th>Al^{3+}</th></tr><tr><th>Cl^-</th><td>NH_4Cl</td><td>$MgCl_2$</td><td>$AlCl_3$</td></tr><tr><th>O^{2-}</th><td>no compound formed</td><td>MgO</td><td>Al_2O_3</td></tr><tr><th>NO_3^-</th><td>NH_4NO_3</td><td>$Mg(NO_3)_2$</td><td>$Al(NO_3)_3$</td></tr></table>		3
(ii)	ammonium nitrate		1
(iii)	**M1** (28 ÷ 80) × 100 **M2** 35(g) **OR** **M1** (100 ÷ 80 =) 1.25 **M2** 1.25 x 28 = 35 (g)	correct answer scores 2 marks ECF from **M1** 17.5 with/without scores 1	2
(b) (i)	**M1 electrostatic** attraction/forces **M2** between oppositely charged ions	 **ACCEPT** between cations and anions	2
(ii)	**M1** magnesium loses electrons and chlorine gains electrons **M2** one atom of magnesium loses two electrons and two atoms of chlorine each gain one electron	 **M2** subsumes **M1** Any mention of sharing of electrons/covalent bonding scores 0	2
(iii)	**M1** add (nitric) acid and silver nitrate **M2** white precipitate	**REJECT** other named acids **ALLOW** correct formulae **M2** dep on silver nitrate in **M1**	2
			Total for question 6 = 12

Question number	Answer	Notes	Marks
7 (a) (i)	all 9 points plotted ± half a square		1
(ii)	points joined with a curved line of best fit, ignoring the anomalous point at 2 minutes		1
(iii)	the student recorded the volume too early		1
(iv)	tangent drawn to the curve at 4 minutes		1
(v)	**M1** suitable values taken from the graph for two coordinates using their tangent  	If no tangent drawn then only M3 can be awarded.	3
	M2 gradient of tangent calculated (expected value = 4.58)	NO ECF from **M1**	
	M3 cm^3/minute	**ALLOW** cm^3/min **OR** cm^3min^{-1}	
(b)	**M1** the reaction has stopped	**IGNORE** no more hydrogen/gas produced/reference to the curve plateauing	2
	M2 because all the acid has reacted		
			Total for question 7 = 9

Question number	Answer	Notes	Marks
8 (a) (i)	F		1
(ii)	B		1
(iii)	E		1
(iv)	A		1
(b) (i)	temperature 600-700 °C	**ALLOW** any temperature in the range **ALLOW** missing units **REJECT** any temperature outside the range	2
	catalyst alumina/silica/aluminosilicates/zeolites	**ALLOW** correct formulae	
(ii)	**M1** shorter alkanes/hydrocarbons (such as C_8H_{18}) are more flammable (than longer alkanes)	**ALLOW** greater demand for short chain alkanes/hydrocarbons (than long chain alkanes) ORA	4
	M2 therefore are more useful/used as fuels	**ALLOW** short chain alkanes needed for specific uses e.g. petrol/gasoline	
	M3 (cracking) produces alkenes (such as C_2H_4)		
	M4 which is used to make polymers/plastics	**ALLOW** ethanol/alcohol	
(c)	**M1** single bond between carbon 2 and carbon 3	**REJECT** if butane is drawn	3
	M2 rest of the repeat unit correct 		
	M3 repeat unit in brackets, trailing bonds present and n to the bottom right	**M3** dep on **M2**	
			Total for question 8 = 13

Question number	Answer	Notes	Marks
9 (a)	**M1** ((63 × 62.5) + (65 × 37.5)) ÷ 100 OR (63 × 62.5%) + (65 × 37.5%) **M2** 63.75 OR 63.8	correct answer scores 2 NO ECF from **M1** Answer of 64 with correct working scores **M1** Answer of **64** without working scores 0	2
(b) (i)	**M1** amount of copper = 158.75 ÷ 63.5 OR 2.5 mol **M2** A_r of M (1000 ÷ 25 =) 40	 **M2** subsumes **M1**	2
(ii)	Ca OR calcium		1
(iii)	**M1** M/Ca is the reducing agent **M2** M/Ca donates/loses electron(s) (to Cu^{2+})	 **M2** dep on **M1** **IGNORE** M/Ca is oxidised	2
(c)	**M1** 10 000 mol of CuO needs 5000 mol of C **M2** 5000 mol of carbon has a mass of 60 kg **OR** **M1** 70 kg of carbon = 5833 mol **M2** which is enough to react with 11667 mol of CuO	 **ACCEPT** alternative method e.g **ALLOW** **M1** 5000 mol of C needed **M2** 70000 ÷ 12 = 5833 mol used, so C is in excess	2
			Total for question 9 = 9

Question number	Answer	Notes	Marks
10 (a) (i)	neutralisation / acid-base		1
(ii)	(sulfuric) acid gives proton(s)/H^+ (to zinc oxide)	**ALLOW** (sulfuric) acid is a proton donor **ALLOW** zinc oxide accepts proton(s)	1
(b)	a description that makes reference to the following three points: **M1** add zinc carbonate/ powder to acid **M2** until no more zinc carbonate reacts **M3** filter (off the excess zinc carbonate/powder) **AND** three of the following points: **M4** heat the solution of zinc sulfate until it is partly evaporated/crystals form/saturated solution **M5** leave solution to cool/to crystallise **M6** filter off crystals **M7** suitable method of drying the crystals	 **ALLOW** until there is no more effervescence **M3** subsumes **M2** as long as excess zinc carbonate is mentioned If heat to dryness only **M1, M2, M3 and M4** can be scored If just left the solution to evaporate only M6 and M7 can be scored **ALLOW** pour off excess liquid/decant off the solution **IGNORE** references to washing e.g. using filter paper/using paper towel/in a (warm) oven/leave in a warm place to dry **REJECT** hot oven or any method of direct heating e.g. Bunsen **ALLOW** leave crystals to dry but not just dry the crystals No **M7** if crystals are washed after drying	6

(c)	M1 mass of zinc sulfate = 8.05 (g) **AND** mass of water = 6.3 (g) **M2** amount of zinc sulfate = 8.05 ÷ 161 OR 0.05 (mol) **AND** 6.3 ÷ 18 OR 0.35 (mol) **M3** 0.35 ÷ 0.05 (=7) **OR** **M1** mass of hydrated zinc sulfate = 14.35 (g) **AND** mass of anhydrous zinc sulfate = 8.05 (g) **M2** amount of zinc sulfate = 8.05 ÷ 161 OR 0.05 (mol) **AND** M_r of hydrated zinc sulfate = (14.35 ÷ (0.05) =) 287 **M3** (287 – 161) ÷ 18 (= 7)	 **M2** subsumes **M1** **ECF** for M2 only **M3** subsumes **M1** and **M2** **ALLOW** M_r of hydrated zinc sulfate = 14.35 ÷ (8.05 ÷ 161) = 287 for **M2**	3
(d) (i)	 **M1**(amount of zinc hydroxide) = 0.250 ÷ 2 OR 0.125 (mol) **M2** maximum mass of zinc hydroxide = 0.125 × 99 OR 12.375 (g) **M3** ((11.3 ÷ 12.375) × 100 =) 91.3(%) **OR** **M1** (amount of zinc hydroxide) = 0.250 ÷ 2 OR 0.125 (mol) **M2** amount of zinc hydroxide produced (= 11.3 ÷ 99) = 0.114 (mol) **M3** ((0.114 ÷ 0.125) × 100 =) 91.3(%)	correct answer scores 3 **M2** subsumes M1 **ALLOW** ECF from **M2** **ACCEPT** 87.8 OR 88(%) if using 0.13 x 99 in **M2** **ALLOW** 45.7(%) scores 2 (step **M1** missed) **ALLOW** any number of SF except 1	3
(ii)	zinc hydroxide/sample is wet/not dry **OR** contamination of zinc hydroxide/sample is caused by an identified error that would result in a greater mass	**ALLOW** more ammonium hydroxide added e.g. some left over zinc hydroxide/solids from previous experiments	1
			Total for question 10 = 15

Question number	Answer	Notes	Marks
11 a	they contain one type of atom		1
11 b	**M1** (graphite has) weak forces between its layers **M2** so layers can slide/slip (over one another)	**REJECT** weak intermolecular forces/layers of molecules/ions	2
c	diamond **M1** giant (covalent) structure/giant lattice **M2** strong covalent bonds C_{60} fullerene **M3** simple molecular (structure) **M4** weak intermolecular forces comparison **M5** more (thermal/heat) energy is needed to break the covalent bonds (in diamond) than to break / overcome the intermolecular forces (in C_{60} fullerene)/to separate the (C_{60} fullerene) molecules	 **ALLOW** macromolecular **IGNORE** giant molecule **REJECT** ionic **ACCEPT** strong (electrostatic) forces between the shared pair of electrons and nuclei no **M2** if reference to intermolecular forces/ ions in diamond **ALLOW** C_{60} exists as molecules **ALLOW** the attractions between the molecules are weak **ALLOW** weak intermolecular bonds NOT just heat	5
d	 **M1** M_r of C_{60} = 720 **M2** 720 ÷ 6.02×10^{23} **M3** mass of 1 molecule = 1.196×10^{-21}(g)	correct answer scores 3 ECF from **M1** ECF from **M2** for correct calculation method and answer in standard form **ALLOW** any number of SF except 1	3
			total for question 11 = 11