

Group 1 & 2

Mark Scheme 2

Level	International A Level
Subject	Chemistry
Exam Board	Edexcel
Topic	Application of Core Principles of Chemistry
Sub Topic	Group 1 & 2
Booklet	Mark Scheme 2

Time Allowed: 52 minutes
Score: /43
Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

Question Number	Acceptable Answers	Reject	Mark
<p>1 * (a)</p>	<p>These marks are independent</p> <p>The outer electrons are further from the nucleus / the electron being removed is further from the nucleus/ larger atomic radius (in calcium)</p> <p>ALLOW Ca has one more shell/ more shells (of electrons) (1)</p> <p>More shielding (in calcium) (1)</p> <p>OR Reverse argument for magnesium</p> <p>ALLOW Discussion based on trend going down group without specifying Mg and Ca</p> <p>IGNORE repulsion between shells</p>	<p>Larger ionic radius (in Ca) Just "Calcium is larger" Reference to molecules, delocalised electrons Just "Ca has more energy levels"</p> <p>Two more shells</p> <p>Any reference to polarising power of ions</p>	<p>2</p>

Question Number	Acceptable Answers	Reject	Mark
1 (b)	<p>Electrons are promoted/ jump / become excited to higher energy level (1)</p> <p>Electron(s) return/ fall back to lower energy level</p> <p>ALLOW to ground state (1)</p> <p>Release of (visible) light (energy) upon return / energy is released in visible spectrum</p> <p>ALLOW release of photons upon return (1)</p>		3

Question Number	Acceptable Answers	Reject	Mark
1 (c) (i)	<p>$\text{CaO} + 2\text{HNO}_3 \rightarrow \text{Ca}(\text{NO}_3)_2 + \text{H}_2\text{O}$</p> <p>Ignore state symbols even if incorrect</p>		1

Question Number	Acceptable Answers	Reject	Mark
<p>1 (c)(ii)</p>	<p>Observation mark: (Calcium nitrate) produces a brown/red-brown gas</p> <p>ALLOW NO₂ for gas Fumes for gas</p> <p>OR (Potassium nitrate) does not produce a brown gas</p> <p>IGNORE Oxygen is given off / Gas given off relights a glowing splint (1)</p> <p>Second mark (can also be an observation): (Only calcium nitrate) produces the oxide</p> <p>OR (Only potassium nitrate) produces the nitrite</p> <p>OR calcium nitrate is less stable to heat</p> <p>OR potassium nitrate decomposes at a higher temperature/takes longer to produce oxygen (1)</p> <p>ALLOW "Calcium nitrate produces a white solid and potassium nitrate produces a yellow solid" as an alternative for either mark</p> <p>NOTE Reject comparisons with one correct and one incorrect statement (this applies to both marks)</p>	<p>Flame colours</p> <p>Reference to other incorrect products.</p>	<p>2</p>

Question Number	Acceptable Answers	Reject	Mark
1 (d) (i)	Hydrogen (gas) / H ₂ If name and formula are given both must be correct		1

Question Number	Acceptable Answers	Reject	Mark
1 (d) (ii)	White ppt/white solid/goes milky/goes cloudy/ white suspension (1) Ca(OH) ₂ + CO ₂ → CaCO ₃ + H ₂ O (1) ALLOW Alternative answer White precipitate forms which dissolves with excess carbon dioxide (1) Ca(OH) ₂ + 2CO ₂ → Ca(HCO ₃) ₂ (1)	White solution / any solution produced	2

Question Number	Acceptable Answers	Reject	Mark
1 (d) (iii)	(One of): Sr(OH) ₂ /Ba(OH) ₂ /Ra(OH) ₂ OR (One of): Strontium/Barium/Radium hydroxide If name and formula given then both must be correct	SrOH/ BaOH/ RaOH Just Sr/ Ba/ Ra Mg(OH) ₂ /MgOH/ magnesium hydroxide/ Be(OH) ₂ /BeOH/ beryllium hydroxide	1

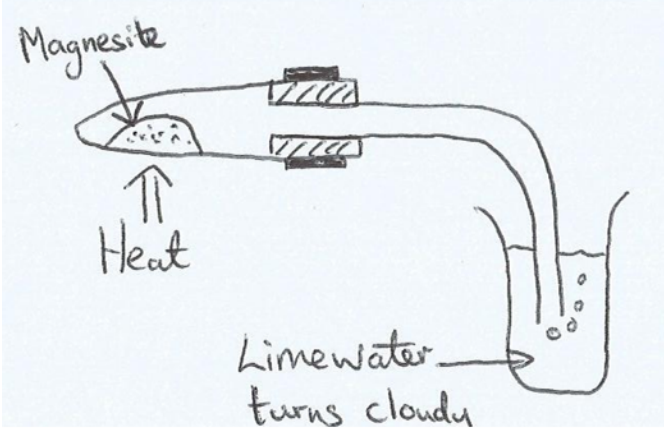
Question Number	Acceptable Answers	Reject	Mark
1 (e)(i)	<p>White ppt/solid ALLOW White crystals</p> <p>(1)</p> <p>(BaSO₄ is insoluble but) MgSO₄ is (very) soluble / MgSO₄ gives a colourless solution/ MgSO₄ gives no precipitate</p> <p>ALLOW BaSO₄ does not dissolve</p> <p>TE on first mark if it stated that a precipitate formed even if colour is wrong/ missing</p> <p>(1)</p>	<p>White ppt of BaCl₂ / MgCl₂ Extra observations eg effervescence</p> <p>Magnesium is soluble / barium is insoluble A precipitate of magnesium sulfate forms and then dissolves Just "MgSO₄ is more soluble / less insoluble" Reference to solubility of chlorides There would be no reaction</p>	2

Question Number	Acceptable Answers	Reject	Mark
1 (e)(ii)	<p>Barium sulfate is not absorbed/ is insoluble</p> <p>IGNORE Comments on X-rays Barium sulfate is not digested Barium sulfate is unreactive/ does not react with stomach acids References to toxicity.</p>	Just 'Barium'	1

Question Number	Acceptable Answers	Reject	Mark
1 (f)	<p>First mark: (Increase) concentration of HCl (1)</p> <p>Second mark More particles/ moles of (HCl) in the same volume OR more (frequent/ successful) collisions</p> <p>Allow second mark only if factor is concentration (1)</p> <p>-----</p> <p>Any two from three of the following for third and fourth marks:</p> <p>Reduce particle size / use powder (instead of lumps)/ use finely divided (solid) (1)</p> <p>(Increases) surface area (1)</p> <p>more (frequent/ successful) collisions (1)</p> <p>ALLOW Reverse arguments</p>	<p>Increase concentration of CaCO₃/HCl and CaCO₃ /reactants</p> <p>Increase kinetic energy of particles</p> <p>Increase kinetic energy of particles</p>	4

Question Number	Acceptable Answers	Reject	Mark
1(g)	<p>Pressure only affects gaseous reactions/ there are no gaseous reactants (or products) /there is no significant volume change/ liquids are incompressible</p> <p>ALLOW pressure doesn't affect solids/ solutions</p> <p>Note: there are many possible correct ways of expressing the idea that pressure only affects rate of reactions involving gases.</p> <p>IGNORE Number of moles in reaction doesn't change</p>		1

TOTAL FOR Q1 = 20 MARKS

Question Number	Acceptable Answers	Reject	Mark
2(a)	<p>Diagram similar to:</p>  <p>Marking point 1 Heat/Bunsen flame and Magnesite (1)</p> <p>Marking point 2 Suitable container and delivery tube dipping into the liquid ALLOW the collection of gas over water/ syringe (1)</p> <p>Marking point 3 Limewater turns cloudy/milky/white precipitate (1)</p> <p>ALLOW alternative correct diagrams e.g. use of teat pipette to collect carbon dioxide</p> <p>The limewater change can be stated on the diagram or on the lines provided.</p> <p>Clamp not required</p>	System sealed	3

Question Number	Acceptable Answers	Reject	Mark
2(b)	$\text{Mg(OH)}_2(\text{s}) \rightarrow \text{MgO}(\text{s}) + \text{H}_2\text{O}(\text{g}) / (\text{l})$ Equation (1) State symbols (1) OR multiples Symbol mark dependent on correct equation	(aq)	2

Question Number	Acceptable Answers	Reject	Mark
2(c)	Any from: $\text{Ca(OH)}_2/\text{Sr(OH)}_2/\text{Ba(OH)}_2$ ALLOW Ra(OH)_2	Be(OH)_2	1

Question Number	Acceptable Answers	Reject	Mark
2(d)	Mg_3N_2 (1) Energy from (burning) magnesium/the reaction... and breaks the $\text{N}\equiv\text{N}$ triple bond ALLOW breaks down nitrogen molecules (1) Carry out in a mixture of an inert gas (argon) and oxygen (gas) ALLOW Carry out in (pure) oxygen (gas) OR Carry out in steam (1)	Just 'remove nitrogen'	3

Question Number	Acceptable Answers	Reject	Mark
2(e)	Electrons are... promoted OR excited OR moved to a higher energy level (1)	Proton	4
	Electrons... return to lower energy level OR return to ground state OR fall back (1)		
	Energy/Light/Radiation/Photon is emitted/released upon return (1) IGNORE colour is released		
	(For magnesium compounds) this energy/ radiation/photon is not in the visible region ALLOW light is not in the visible region (1)		

Question Number	Acceptable Answers	Reject	Mark
2(f)	$2\text{Mg}(\text{NO}_3)_2 \rightarrow 2\text{MgO} + 4\text{NO}_2 + \text{O}_2$ OR multiples Ignore state symbols even if incorrect		1

Question Number	Acceptable Answers	Reject	Mark
2(g)	H_2SO_4 ALLOW As part of the following equation $\text{MgO} + \text{H}_2\text{SO}_4 \rightarrow \text{MgSO}_4 + \text{H}_2\text{O}$ Ignore sulfuric acid and references to concentration		1

Question Number	Acceptable Answers	Reject	Mark
2(h)(i)	<p>If $x = 6.41$ (from $M_r = 120/120.1$) 6.42 (from $M_r = 120.3$) 6.43 (from $M_r = 120.4$) and there is some evidence of working, award all 3 marks</p> <p>If the masses of water and $MgSO_4$ are transposed, then $x = 6.96$ and scores 2</p> <p>Answer must be to 3SF Answer alone scores (1)</p> <p>$n(MgSO_4) = 2.55 \div 120.4 = 0.021179$ (mol) (1)</p> <p>$(m(H_2O) = 5.00 - 2.55 = 2.45)$ $n(H_2O) = 2.45 \div 18 = 0.136111$ (mol) (1)</p> <p>(Ratio 1:6.43) $x = 6.43$ TE on calculated values above (1)</p> <p>ALTERNATIVE METHOD</p> <p>$2.55 \div 5 = 120.4 \div (120.4 + 18x)$ (1)</p> <p>$0.51(120.4 + 18x) = 120.4$ (1)</p> <p>$61.404 + 9.18x = 120.4$</p> <p>$X = 6.43$ (1)</p> <p>Penalise use of 1SF in intermediate values OR final answer not 3SF</p>		3

Question Number	Acceptable Answers	Reject	Mark
2(h)(ii)	Heat to constant mass ALLOW Heat for a longer period of time (1) To ensure all the water is removed ALLOW To ensure all the water is evaporated (1) Second mark is dependent on first For max (1) Solid may 'spit' and lose mass and so heat gently OR Use a larger mass of Epsom salts to reduce percentage error (of weighing)	Just 'Heat more strongly'	2

Question Number	Acceptable Answers	Reject	Mark
2(i)	90(°) (1) Four bonded pairs of electrons (in a flat/planar ring) result in maximum separation/minimum repulsion (1) If a bond angle of 109.5° is given then the second mark can be awarded for four bonded electron pairs repelling to maximum separation/minimum repulsion		2

Question Number	Acceptable Answers	Reject	Mark
2(j)	Layer/barrier of magnesium oxide forms OR magnesium oxide forms on the surface (preventing further reaction)		1

TOTAL FOR SECTION C (QUESTION 2) = 23 MARKS