Paper 1 Foundation

Question number	Answer	Mark
1(a)(i)	liquid solid gas • all three correct (2) • one/two correct (1)	(2)

Question number	Answer	Mark
1(a)(ii)	• Bunsen burner (1) • test tube (1)	(2)

Question number	Answer	Additional guidance	Mark
1(b)	evaporation	do not accept 'boiling'	(1)

Question number	Answer	Mark
1(c)(i)	An answer that provides a description by making reference to **two** of the following points: • molecules become closer (1) • molecules lose energy (1) • molecules slow down (1)	(2)

Question number	Answer	Mark
1(c)(ii)	B	(1)

Question number	Answer	Mark
2(a)	B	(1)

Question number	Answer	Mark
2(b)	Any **one** advantage from: • reliable composition of fertiliser • produced in large quantities as required • all soluble therefore fertiliser will reach roots as required	(1)

Question number	Answer	Additional guidance	Mark
2(c)(i)	measuring cylinder	allow burette or pipette	(1)

Question number	Answer	Mark
2(c)(ii)	(ammonia) + phosphoric acid → ammonium phosphate	(1)

Question number	Answer	Mark
2(c)(iii)	An answer that combines the following points of application of knowledge and understanding to provide a logical description: • first heat the solution/leave water to evaporate (1) • and then filter off/dry crystals formed (1)	(2)

Question number	Answer	Mark
2(d)	D	(1)

Question number	Answer	Mark
3(a)	B	(1)

Question number	Answer	Mark
3(b)(i)	• iron (1) • carbon dioxide/carbon monoxide (1)	(2)

Question number	Answer	Mark
3(b)(ii)	D	(1)

Question number	Answer	Mark
3(c)	all the original atoms have simply been rearranged in the products.	(1)

Question number	Answer	Mark
3(d)	heating with carbon is used as it is cheaper than using electrolysis.	(1)

Question number	Answer	Mark
3(e)	• tin costs {much/about 10 times} more than aluminium (1) • amount of tin in Earth much smaller than the amount of aluminium (1)	(2)

Question number	Answer	Mark
4(a)(i)	• connect {lamp/ammeter} in series (1)	(1)

Question number	Answer	Mark
4(a)(ii)	• a substance that conducts electricity (1) • when molten or in aqueous solution (1)	(2)

Question number	Answer	Mark
4(a)(iii)	B	(1)

Question number	Answer	Additional guidance	Mark
4(b)	• copper is deposited on the cathode, therefore mass deposited = 1.57 – 1.28 (1) • = 0.29 (g) (1)	Award full marks for correct numerical answer without working.	(2)

Question number	Answer	Mark
4(c)	• iodine at the anode (1) • potassium at the cathode (1)	(2)

Question number	Answer	Mark
4(d)	• 84 g sodium fluoride → 46 g of sodium (1) • so 168 g sodium fluoride → 92 g of sodium (1) **or** • 168 ÷ 42 = 4 (mol NaF) (1) • 4 × 23 = 92 (g) (1)	(2)

Question number	Answer	Mark
5(a)	• improve appearance (1) • help prevent corrosion (1)	(2)

Question number	Answer	Additional guidance	Mark
5(b)	% of tin in alloy = $\frac{15.0}{(15.0+22.5)} \times 100$ (1) = 40.0 (%) (1)	Award full marks for correct numerical answer without working.	(2)

Question number	Answer	Mark
5(c)	• A will rust, as there is air/oxygen and water present (1) • B will not rust, as there is no air/oxygen present (1) • C will not rust, as no water is present (1)	(3)

Question number	Answer	Mark
5(d)	An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (1 mark): • (iron has not rusted because) zinc is more reactive than iron (1) • so zinc corrodes instead of iron (1)	(2)

Question number	Answer	Additional guidance	Mark
6(a)(i)	• axes with linear scale that use more than half of each edge of the grid (1) • all points correctly plotted to ± half a square (1) • single straight line passing through all points except result 5 (1)	5 points plotted correctly (i.e. one error) allow ecf from plotting error	(3)

Question number	Answer	Mark
6(a)(ii)	Any **one** reason from: • not all magnesium reacted • incomplete reaction • some magnesium oxide lost	(1)

Question number	Answer	Mark
6(b)	$\mathbf{2}Mg + O_2 \rightarrow \mathbf{2}MgO / Mg + \mathbf{\frac{1}{2}}O_2 \rightarrow MgO$	(1)

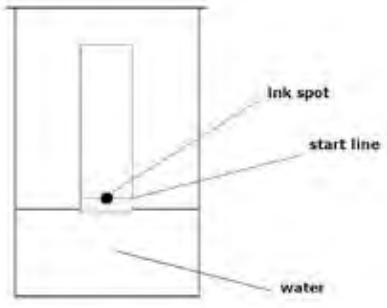
Question number	Answer	Additional guidance	Mark
6(c)	40 + 2 × (14 + 16 × 3) (1) = 164 (1)	Award full marks for correct numerical answer without working.	(2)

Question number	Answer	Mark
6(d)	• divide mass by relative atomic mass: lead $\frac{0.207}{207} = 0.001$; oxygen $\frac{0.032}{16} = 0.002$ (1) • divide by the smaller: $\frac{0.001}{0.001} = 1$; $\frac{0.002}{0.001} = 2$ (1) empirical formula PbO_2 which is different to that of compound R (1)	(3)

Question number	Answer	Mark
7(a)	D	(1)

<table>
<tr><th>Question number</th><th>Answer</th><th>Mark</th></tr>
<tr><td>7(b)</td><td>One mark for each correct row.
<table>
<tr><td rowspan="2">substance to separate</td><td colspan="4">method of separation</td></tr>
<tr><td>crystallisation</td><td>filtration</td><td>simple distillation</td><td>fractional distillation</td></tr>
<tr><td>sand from a mixture of sand and sodium chloride solution</td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>copper sulfate crystals from copper sulfate solution</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>useful liquids from crude oil</td><td></td><td></td><td></td><td>✓</td></tr>
</table></td><td>(3)</td></tr>
</table>

Question number	Answer	Mark
7(c)(i)	pencil is insoluble in the solvent (but chromatography would separate the ink in an ink line)	**(1)**

Question number	Answer	Mark
7(c)(ii)	Correct position of chromatography paper with start line and ink spot above surface of water 	**(1)**

Question number	Answer	Additional guidance	Mark
7(c)(iii)	• R_f = 14.5 / 15.3 = 0.9477 (1) • = 0.95 answer to 2 significant figures (1)	Award full marks for correct numerical answer without working.	(2)

Question number	Answer	Mark
7(d)(i)	B	(1)

Question number	Answer	Mark
7(d)(ii)	use a different solvent.	(1)

Question number	Answer	Mark
7(d)(iii)	an explanation that combines identification via a judgement (1 mark) to reach a conclusion via justification/reasoning (1 mark): • mixture S (1) • because it gives the greatest number of spots/gives four spots (1)	(2)

Question number	Answer	Mark
8(a)	any **one** precaution from: • wear gloves to prevent contact with skin/safety (1) • spectacles to prevent contact with eyes (1)	(1)

Question number	Answer	Additional guidance	Mark
8(b)	1000 cm^3 contain $\frac{4.3 \times 1000}{250}$ (1) 1 dm^3 contains 17.1 ($g\,dm^{-3}$) (1)	Award full marks for correct numerical answer without working.	(2)

Question number	Answer	Additional guidance	Mark
8(c)	$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$ • correct formulae (1) • balancing (1)	Do not award 2 if incorrect balancing added.	(2)

Question number	Answer	Mark
8(d)	• {titration 1/27 cm^3} should not be used because burette readings {not precise/not accurate/not read to 2 d.p.} (1) • {titration 4/25.80 cm^3} should not be used because volume of used (25.80 cm^3) not concordant with other two (1)	(2)

Question number	Indicative content
*8(e)	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material that is indicated as relevant. Additional content included in the response must be scientific and relevant. **AO1 (6 marks)** • rinse pipette with alkali and burette with acid • measure alkali using a pipette into suitable container e.g. flask/beaker and place flask on a white tile • add a few drops of indicator/suitable named indicator (eg methyl orange/phenolphthalein) • fill burette with acid and read volume of acid in burette • add acid from burette to the flask slowly swirling the flask until {indicator just changes colour/correct colour change for named indicator (eg methyl orange yellow to peach/orange, phenolphthalein pink to colourless)/solution is neutral} • read volume of acid in burette at end of titration • repeat experiment until concordant results • mix the same volume of alkali with the volume of acid determined from the titration but do not add indicator • pour solution into an evaporating basin then {heat solution/leave the water to evaporate} until pure salt crystals are left • dry crystals using absorbent paper

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1-2	• Demonstrates elements of chemical understanding, some of which is inaccurate. Understanding of scientific, enquiry, techniques and procedures lacks detail. (AO1) • Presents a description which is not logically ordered and with significant gaps. (AO1)
Level 2	3-4	• Demonstrates chemical understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas, enquiry, techniques and procedures is not fully detailed and/or developed. (AO1) • Presents a description of the procedure that has a structure which is mostly clear, coherent and logical with minor steps missing. (AO1)
Level 3	5-6	• Demonstrates accurate and relevant chemical understanding throughout. Understanding of the scientific ideas, enquiry, techniques and procedures is detailed and fully developed. (AO1) • Presents a description that has a well-developed structure which is clear, coherent and logical. (AO1)

Question number	Answer	Additional guidance	Mark
9(a)	An explanation that combines identification via a judgement (1 mark) to reach a conclusion via justification/reasoning (1 mark): • a negative ion must have more electrons than protons in the particle (1) • therefore Z will have a 2– charge (1)	Do not allow any comparison involving neutrons.	**(2)**

Question number	Answer	Mark
9(b)	• Li ion with empty outer shell (1) • 1+ charge on Li (1) • 8 electrons on outer shell of F (1) • 1– charge on F (1)	**(4)**

Question number	Indicative content
*9(c)	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material that is indicated as relevant. Additional content included in the response must be scientific and relevant. **AO2 (6 marks)** • solid calcium chloride contains ions/cations/anions which are charged particles • solid calcium chloride does not conduct because charged particles are not free to move because they are held together by strong electrostatic forces/ionic bonds in lattice • molten calcium chloride solution conducts because ions/cations/anions are present which are charged particles and are free to move • the ions have separated and move to electrode of opposite charge • diamond does not conduct because it is giant molecular covalent with no free electrons • outer electrons of carbon atoms used in bonding • zinc metallic structure consists of delocalised free electrons which can move between layers of metals atoms/cations

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1-2	• The explanation attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question. (AO2) • Lines of reasoning are unsupported or unclear. (AO2)
Level 2	3-4	• The explanation is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question. (AO2) • Lines of reasoning mostly supported through the application of relevant evidence. (AO2)
Level 3	5-6	• The explanation is supported throughout by linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the context of the question. (AO4) • Lines of reasoning are supported by sustained application of relevant evidence. (AO2)

Question number	Answer	Mark
10(a)	<table><tr><th>salt</th><th>soluble</th><th>insoluble</th></tr><tr><td>ammonium chloride</td><td>✓</td><td></td></tr><tr><td>lithium sulfate</td><td>✓</td><td></td></tr><tr><td>magnesium carbonate</td><td></td><td>✓</td></tr></table> • All three correct (2) • Any two correct (1)	**(2)**

Question number	Answer	Additional guidance	Mark
10(b)	• mass values in correct places (1) • multiplication by 100 (1) • correct final answer to two significant figures (1)	$\frac{2.53}{2.85} \times 100 = 88.8\%$ 89% (to 2 s.f.) award full marks for correct numerical answer without working	**(3)**

Question number	Answer	Mark
10(c)	An explanation that combines identification – improvement of the experimental procedure (maximum 2 marks) and justification/reasoning, which must be linked to the improvement (maximum 2 marks): • add excess sodium sulfate solution rather than a few drops (1) • so more reaction occurs to form more lead sulfate (1) • filter the reaction mixture rather than pour off the liquid (1) • so none of the lead sulfate is lost on separation (1) • wash the lead sulfate (1) • so the impurities are removed (1) • place the lead sulfate in an oven/warm place (1) • so the lead sulfate is dry (1)	**(4)**

Question number	Answer	Mark
10(d)	• volumes of solution too large for titration method (1) • large volumes of liquid need to be heated and then allowed to crystallise (1)	**(2)**