<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>1 a</td><td>M1 (step 1) nitric acid

M2 (step 2) magnesium carbonate is insoluble / magnesium carbonate does not form a solution

M3 (step 3) boiling off all the water (will not produce a hydrated salt)</td><td>ACCEPT sulfuric acid should be used

REJECT the use of reagents that would not work, eg magnesium chloride</td><td>3</td></tr>
<tr><td>1 b i</td><td><table><tr><td>M1 (after)</td><td>23.80</td></tr><tr><td>M2 (before)</td><td>2.15</td></tr><tr><td>M3 (volume added)</td><td>21.65</td></tr></table></td><td>If both readings are correct but in the wrong order, award 1 mark for M1 and M2

M3 CQ on the values given for M1 and M2

Penalise missing trailing zeros once only</td><td>3</td></tr>
<tr><td>b ii</td><td>M1 (the calculated) volume will be higher

M2 because it includes the air (contained in the tip of the burette)</td><td>M2 dep on M1</td><td>2</td></tr>
</table>

c i	ticks in columns 2 and 4		1
ii	**M1** $\frac{26.45 + 26.25}{2}$	CQ on any combination of ticked results If no results are ticked then **M1** can only be awarded if the values from columns 2 and 4 are averaged If only one column ticked then no marks can be awarded in (c)(ii)	2
	M2 26.35 (cm^3)	CQ on results averaged Answers should be to 2dp, except trailing zero not needed Correct final answer without working scores 2	

Question number	Answer	Notes	Marks
1 d	**M1** heat/boil until crystals form in a sample of solution that has been removed (and cooled)	**ACCEPT** heat/boil to produce a (hot) saturated/concentrated solution **ACCEPT** heat until crystals start/begin to form **ALLOW** (heat/boil to) evaporate some of the water **ALLOW** heat/boil to crystallisation point **IGNORE** references to filtering before heating	3
	M2 leave (the solution) to cool (so that crystals form)	**M2** dep on **M1**	
	M3 filter (to obtain crystals) **AND** suitable method of drying crystals	**ACCEPT** decant/pour off the liquid/(excess)solution for filter eg place in (warm) oven / leave to dry (in warm place) / use filter paper / use kitchen towel **REJECT** any reference to heating directly with a flame, eg with a Bunsen **IGNORE** reference to washing crystals **M3** dep on **M1** If **M1** not scored then award 1 mark out of 3 for leaving the solution until the water evaporates fully	

Question number	Answer	Notes	Marks
2 a i	no more precipitate forms OR no more lead(II) sulfate forms	Accept usual alternatives for precipitate Ignore references to fizzing / temperature/ change in colour	1
ii	cross in box **D** (sulfuric acid)		1
iii	they would obtain sodium nitrate instead OR the filtrate does not contain lead(II) sulfate/the insoluble salt OR the lead(II) sulfate/insoluble salt has already been obtained in step 3 OR they should have used the residue (not the filtrate)	Accept the soluble salt in place of sodium nitrate	1
iv	wash/pour water over the solid/residue warm / heat / place in oven / leave (to dry)	 Accept on filter paper/kitchen towel/tissue paper/desiccator	1 1
v	cross in box **C** (is insoluble in water)		1
b i	0.15(0) mol for <u>BOTH</u> substances		1
ii	0.15(0) ÷ 0.5(00)		1
	0.3(00) dm^3 / 300 cm^3	Unit needed for mark Correct final answer with no working scores 2	1

(Total for Question 2= 9 marks)

<table>
<tr><th>Question number</th><th>Expected Answer</th><th>Accept</th><th>Reject</th><th>Marks</th></tr>
<tr><td>3</td><td>
<table>
<tr><th>pH at start</th><th>pH at end</th><th>Correct letter</th></tr>
<tr><td>7</td><td></td><td>A</td></tr>
<tr><td>7</td><td>1</td><td>E</td></tr>
<tr><td>14</td><td>7</td><td>C</td></tr>
<tr><td>7</td><td></td><td>B</td></tr>
</table>
</td><td></td><td></td><td>1
1
1
1</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>4</td></tr>
</table>

<table>
<tr><th>Question number</th><th>Answer</th><th>Accept</th><th>Reject</th><th>Marks</th></tr>
<tr><td>4 (a)</td><td>
<table>
<tr><th>Highest temperature</th><th>Temperature rise</th></tr>
<tr><td>28</td><td>3</td></tr>
<tr><td>30</td><td>6</td></tr>
<tr><td>32</td><td>9</td></tr>
<tr><td>32</td><td>9</td></tr>
</table>
1 mark for each column correct.
mark temp. rise csq on highest temp.
IGNORE incorrect units</td><td>Readings to 1dp only if zero</td><td></td><td>2</td></tr>
<tr><td>(b) (i)</td><td>M1 & M2 - all points correctly plotted to the nearest gridline

[Deduct 1 mark for each incorrectly plotted point up to a max. of 2]

M3 - <u>straight</u> lines drawn through points 1 to 3 <u>and</u> through points 3 to 5
line does not need to be extrapolated to (0,0)
<u>must</u> be drawn with the aid of a ruler</td><td></td><td></td><td>2

1</td></tr>
<tr><td>(ii)</td><td>0.75 (g)</td><td>correct reading to nearest gridline from candidate's graph</td><td>incorrect unit</td><td>1</td></tr>
</table>

Question number	Answer	Accept	Reject	Marks
4 (c)	copper sulfate/copper ions completely reacted / been used up / run out **IGNORE** copper completely reacted/magnesium is in excess/references to saturated solution / reactant(s) used up	all of the copper has been displaced / deposited reaction complete		1
(d)	**M1** – smaller/larger <u>with magnesium</u> **M2** - fewer moles of metal/zinc added / less copper displaced/fewer moles of copper sulfate reacted / fewer moles of copper ions reacted **IGNORE** references to particles / surface area M2 DEP on M1	less/low<u>er</u> less heat <u>produced</u> ORA less amount fewer atoms of metal/zinc added less (mass/moles of) copper displaced	 less mass of metal/zinc added	1 1
			Total	**9**

<table>
<tr><th>Question number</th><th>Expected Answer</th><th>Accept</th><th>Reject</th><th>Marks</th></tr>
<tr><td>5 (a)</td><td>M1 P – iron ore / haematite
ignore iron(III) oxide/Fe_2O_3

M2 Q - calcium silicate</td><td>

slag / $CaSiO_3$</td><td></td><td>2</td></tr>
<tr><td>(b)</td><td><table><tr><th>Type of reaction</th><th>Letter</th></tr><tr><td>one that gives out heat</td><td>A</td></tr><tr><td>one that is a thermal decomposition</td><td>D ;</td></tr><tr><td>one that is a neutralisation</td><td>E ;</td></tr><tr><td>one that forms a poisonous gas</td><td>B ;</td></tr></table></td><td></td><td></td><td>3</td></tr>
<tr><td>(c)</td><td>M1- oxygen

IGNORE O

M2 – water</td><td>air

O_2

moisture/H_2O</td><td></td><td>2</td></tr>
</table>

(d)	**M1** zinc corrodes/reacts instead of iron / faster than iron **M2** iron corrodes/reacts instead of tin / faster than tin lack of comparison with other metal max 1 from **M1** and **M2** ignore references to tin rusting **M3** correct reference to order of reactivity of all three metals	zinc loses electrons/is oxidised instead of iron iron loses electrons/is oxidised instead of tin accept reverse arguments	zinc rusts (instead of iron)	3

Total 10 marks

<table>
<tr><th>Question number</th><th>Answer</th><th>Accept</th><th>Reject</th><th>Marks</th></tr>
<tr><td>6 (a)</td><td>
<table>
<tr><th rowspan="2">Salt made</th><th rowspan="2">Acid used</th><th colspan="2">Metal compound</th></tr>
<tr><th>Name</th><th>So or aqueous solution</th></tr>
<tr><td></td><td>sulfuric (acid)</td><td></td><td>solid</td></tr>
<tr><td></td><td></td><td>silver nitrate</td><td></td></tr>
<tr><td></td><td>nitric (acid)</td><td></td><td>solid/ aqueous/ solution</td></tr>
</table>
</td><td>correct formulae

silver ethanoate</td><td></td><td>5</td></tr>
<tr><td>(b)</td><td>$H_2SO_4 \rightarrow H^+ + HSO_4^-$ / $H_2SO_4 \rightarrow 2H^+ + SO_4^{2-}$

M1 - formula of both ions correct
M2 – balanced equation</td><td>H_3O^+ in place of H^+</td><td></td><td>2</td></tr>
</table>

Question Number	Answer	A	Reject	Marks
6 (c)	**M1**- dissolve both (lead(II) nitrate and sodium chloride) in water penalise **M1** is any other reagents added	dissolve one in water		1
	M2- mix/add (the two solutions)	react		1
	M3 – filter	decant		1
	M4 - wash <u>residue</u>/<u>solid</u>/<u>lead ((II)) chloride</u> (with deionised/distilled water)			1
	M5 - dry on filter paper/in a (warm) oven/leave to dry /heat	other sensible methods of drying	strong heating	1
			Total	**12**

Question number	Answer	Accept	Reject	Marks
7 (a) (i)	any named soluble metal sulfate / ammonium sulfate / (dilute) sulfuric acid	correct formula	<u>concentrated</u> sulfuric acid	1
(ii)	correct formulae for all compounds (mark consequentially on the sulfate given in (a)(i), even if insoluble, except lead(II) sulfate)	$Pb^{2+} + SO_4^{2-} \rightarrow PbSO_4$ for 2 marks		1
	balanced			1
(iii)	filter			1
	wash / rinse (with distilled / deionised water) If no reference to what is being washed, assume that the residue is being washed			1 1
	filter paper / kitchen roll / blotting paper / absorbent paper /leave (to dry) / (pace in) desiccator / (place in warm) oven / heat			
	If no filtration MAX 1. If implication that filtrate is washed or evaporated , neither M2 nor M3 can be awarded Do not penalise careless use of solution or liquid for reaction mixture			

Question number	Expected Answer	Accept	Reject	Marks
7 (b)	Any two from bubbles (of gas) / fizzing / effervescence Ignore carbon dioxide solid / lead(II) carbonate disappears solution formed / colourless liquid Ignore incorrect starting colours Ignore heat produced and temperature change	gas given off dissolves / less solid	any specific colour	2
			Total	**8**