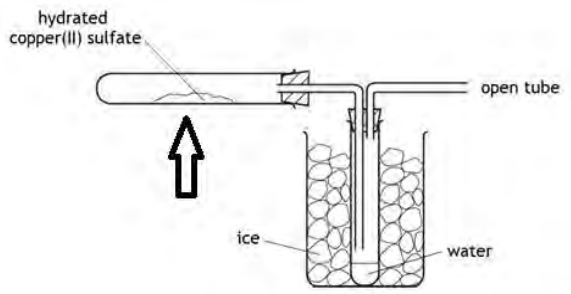
Question number	Answer	Notes	Marks
1 (a)	 NB the arrow must point to the solid	ACCEPT a flame if >1 arrow drawn, all must be correct	1
(b)	to condense the (water) vapour / steam	ACCEPT to cool the water vapour ACCEPT to cool/condense the gas (given off) IGNORE to condense the water IGNORE to stop the water escaping as water vapour IGNORE to condense the product	1
(c)	M1 $n(CuSO_4.5H_2O)$ = 2.50 ÷ 250 OR 0.01 (mol) M2 $n(H_2O)$ = 0.01 x 5 OR 0.05 (mol) M3 mass of water = (0.05 x 18) = 0.9(0) (g) OR M1 5 x 18 OR 90 M2 250 (g) → 90 (g) M3 2.50 (g) → 0.9(0) (g) OR M1 5 x 18 OR 90 M2 90 ÷ 250 x 100 (%) → 36 (%) M3 36 (%) x 2.50 (g) → 0.9(0) (g)	mark csq throughout correct final answer (with no working) scores 3 ACCEPT calculations that use A_r of Cu as 63.5 (giving 0.9(05) (g) as a final answer) M2 subsumes M1 for all methods	3

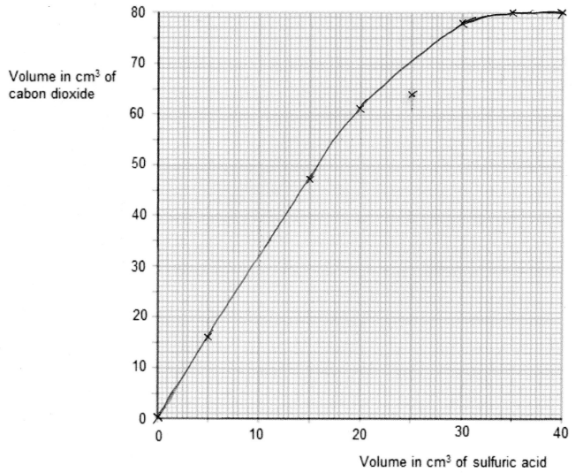
<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>2 (a)</td><td>
<table>
<tr><th>Solid</th><th>Amount</th></tr>
<tr><td>$KHCO_3$</td><td>0.080</td></tr>
<tr><td>K_2O</td><td>0.059</td></tr>
<tr><td>KOH</td><td>0.099</td></tr>
<tr><td>K_2CO_3</td><td>0.040</td></tr>
</table>

all four correct = 2 marks
three correct = 1 mark
</td><td>ALLOW values (corrected rounded) from 1 sf up to calculator value</td><td>2</td></tr>
<tr><td>(b)</td><td>M1 equation 3

M2 the (mole) ratio of $KHCO_3$ to K_2CO_3 /reactant to product is 2:1</td><td>mark csq on amounts given in part (a)</td><td>2</td></tr>
</table>

Question number	Answer	Notes	Marks
3 (a) i	cross in box A (zinc sulfate)		1
ii	cross in box B (iron) cross in box C (magnesium)	Apply list principle - 3 crosses = max 1 4 or 5 crosses = 0 marks	1 1
3 (b)	burns with a pop/squeak OR use burning/lit splint/flame to see if pop/squeak	Must be reference to test and result Reference to splint/match with no indication of flame is not enough Reject reference to glowing splint Ignore flame extinguished 'Squeaky pop test' on its own is not sufficient	1
3 (c)	2 (1) 2	Accept multiples and fractions	1
3 (d) i	cross in box 3		1
ii	reversible / can go in both directions / can go backwards and forwards	Ignore references to equilibrium Ignore references to other reaction types (e.g. hydration / oxidation / exothermic) Accept either equation with ⇌	1
		Total	7

Question number	Answer	Accept	Reject	Marks
4 (a) (i)	measuring cylinder			1
(ii)	M1 44	answers in other correct units, e.g. 0.044 dm^3		1
	M2 cm^3	ml		1
(iii)	M1 $\frac{44 \times 0.01(0)}{1000}$			1
	M2 0.00044(0)		0.0004	1
	Mark csq on answer to (a)(ii)	0.44 for 1 mark only correct answer with no working for 2 marks		
(b)	<u>zinc</u> because			
	M1 1 mol zinc reacts with 2 mol HCl			1
	M2 only 0.005 mol of zinc are needed			1
	M1 is standalone M2 is dep on zinc given as being in excess			
(c) (i)	(rate) increases/faster reaction	less time for reaction to take place	faster time	1
(ii)	no effect/same volume (of hydrogen) produced	none/no change		1
			Total	9

Question number	Answer	Notes	Marks
5 (a)	 M1 & M2 all points correctly plotted to nearest gridline M3 suitable curve of best fit, from the origin	deduct one mark for each incorrectly plotted point do not penalise missing (0, 0) if points are not visible, but graph goes through that point, then do not penalise	3

Question number		Answer	Notes	Marks
(b)	(i)	25 (cm^3)	accept anomalous point based on graph drawn	1
	(ii)	M1 the volumes (of gas) are the same	accept 'no more gas is being produced/collected (after 35 cm^3)'	2
		M2 therefore the reaction has finished / <u>all</u> of the solid/$MgCO_3$ has reacted / the solid/$MgCO_3$ has been used up	reject 'all of the reactants have reacted' reject 'all of the acid has reacted' ignore refs to $MgCO_3$ dissolving accept refs to $MgCO_3$ being limiting reagent	
	(iii)	value correctly read to nearest gridline from candidate's graph		1
	(iv)	value correctly read to nearest gridline from candidate's graph		1

Question number	Answer	Notes	Marks
6 (a) (i)	$2HgO \rightarrow 2Hg + O_2$	accept halves and multiples	1
(ii)	redox	accept '(thermal) decomposition' ignore 'oxidation' allow 'reduction'	1
(b) (i)	(tap / dropping / separating) funnel	reject 'filter / thistle funnel'	1
(ii)	(the gas / it) contains air (from the conical flask)	accept 'contains impurities' or ref to possible named impurity eg nitrogen reject 'water vapour' allow 'contains less <u>oxygen</u>'	1
(c)	M1 perform reaction with and without catalyst M2 keep remaining variables (eg concentration or volume of hydrogen peroxide / temperature) the same M3 measure time (to fill the gas jar with oxygen) M4 <u>oxygen produced</u> more quickly/at a faster rate/in a shorter time (in experiment) with catalyst OR M1 weigh a sample of manganese(IV) oxide	accept: M1 perform reaction with and without catalyst M2 <u>oxygen produced</u> more quickly/at a faster rate/in a shorter time (in experiment) with catalyst M3 weigh a sample of manganese(IV) oxide (before putting it into the conical flask) M4 the mass at the end of the reaction should be the same as at the start	4

	(before putting it into the conical flask) M2 filter (to remove the solid) M3 dry the solid (and re-weigh it) M4 the mass should be the same as before		
(d) (i)	$SO_2 + H_2O \rightarrow H_2SO_3$	accept $SO_2 + H_2O + ½O_2 \rightarrow H_2SO_4$ allow products shown as correct ions	1
(ii)	M1 (Universal Indicator turns) orange/yellow M2 (the solution/it) is acidic / contains hydrogen ions / contains H^+ ions	accept 'red' allow 'contains sulfurous / sulfuric acid'	2