

Acids, Bases and Salt preparations

Mark Scheme 3

Level	IGCSE(9-1)
Subject	Chemistry
Exam Board	Edexcel IGCSE
Module	Single Award (Paper 2C)
Topic	Inorganic Chemistry
Sub-Topic	Acids, Bases and salt preparations
Booklet	Mark Scheme 3

Time Allowed: 80 minutes

Score: /66

Percentage: /100

Grade Boundaries:

9	8	7	6	5	4	3	2	1
>90%	80%	70%	60%	50%	40%	30%	20%	10%

Question number	Answer	Notes	Marks						
1 a	<p>M1 (step 1) nitric acid</p> <p>M2 (step 2) magnesium carbonate is insoluble / magnesium carbonate does not form a solution</p> <p>M3 (step 3) boiling off all the water (will not produce a hydrated salt)</p>	<p>ACCEPT sulfuric acid should be used</p> <p>REJECT the use of reagents that would not work, eg magnesium chloride</p>	3						
1 b i	<table border="1"> <tbody> <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> </tbody> </table>	M1 (after)	23.80	M2 (before)	2.15	M3 (volume added)	21.65	<p>If both readings are correct but in the wrong order, award 1 mark for M1 and M2</p> <p>M3 CQ on the values given for M1 and M2</p> <p>Penalise missing trailing zeros once only</p>	3
M1 (after)	23.80								
M2 (before)	2.15								
M3 (volume added)	21.65								
b ii	<p>M1 (the calculated) volume will be higher</p> <p>M2 because it includes the air (contained in the tip of the burette)</p>	<p>M2 dep on M1</p>	2						

c	<p>i ticks in columns 2 and 4</p> <p>ii M1 $\frac{26.45 + 26.25}{2}$</p> <p>M2 26.35 (cm³)</p>	<p>CQ on any combination of ticked results</p> <p>If no results are ticked then M1 can only be awarded if the values from columns 2 and 4 are averaged</p> <p>If only one column ticked then no marks can be awarded in (c)(ii)</p> <p>CQ on results averaged Answers should be to 2dp, except trailing zero not needed</p> <p>Correct final answer without working scores 2</p>	<p>1</p> <p>2</p>
---	--	---	---

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

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		1
	warm / heat / place in oven / leave (to dry)	Accept on filter paper/kitchen towel/tissue paper/desiccator	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 / 300cm ³	Unit needed for mark Correct final answer with no working scores 2

(Total for Question 2= 9 marks)

Question number	Expected Answer			Accept	Reject	Marks
3	pH at start	pH at end	Correct letter			
	7		A			1
	7	1	E			1
	14	7	C			1
	7		B			1
				Total	4	

Question number	Answer		Accept	Reject	Marks										
4 (a)	<table border="1"> <thead> <tr> <th>Highest temperature</th> <th>Temperature rise</th> </tr> </thead> <tbody> <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> </tbody> </table>		Highest temperature	Temperature rise	28	3	30	6	32	9	32	9	Readings to 1dp only if zero		2
Highest temperature	Temperature rise														
28	3														
30	6														
32	9														
32	9														
(b) (i)	<p>M1 & M2 - all points correctly plotted to the nearest gridline</p> <p>[Deduct 1 mark for each incorrectly plotted point up to a max. of 2]</p> <p>M3 - <u>straight</u> lines drawn through points 1 to 3 and through points 3 to 5</p> <p>line does not need to be extrapolated to (0,0)</p> <p><u>must</u> be drawn with the aid of a ruler</p>				2										
(ii)	0.75 (g)		correct reading to nearest gridline from candidate's graph	incorrect unit	1										

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/lower 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

Question number	Expected Answer	Accept	Reject	Marks										
5 (a)	<p>M1 P – iron ore / haematite ignore iron(III) oxide/Fe_2O_3</p> <p>M2 Q - calcium silicate</p>	slag / CaSiO_3		2										
(b)	<table border="1"> <thead> <tr> <th>Type of reaction</th> <th>Letter</th> </tr> </thead> <tbody> <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> </tbody> </table>	Type of reaction	Letter	one that gives out heat	A	one that is a thermal decomposition	D ;	one that is a neutralisation	E ;	one that forms a poisonous gas	B ;			3
Type of reaction	Letter													
one that gives out heat	A													
one that is a thermal decomposition	D ;													
one that is a neutralisation	E ;													
one that forms a poisonous gas	B ;													
(c)	<p>M1- oxygen</p> <p>IGNORE O</p> <p>M2 – water</p>	air O_2 moisture/ H_2O		2										

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

Total 10 marks

Question number	Answer	Accept	Reject	Marks																		
6 (a)	<table border="1"> <thead> <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> </thead> <tbody> <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> </tbody> </table>	Salt made	Acid used	Metal compound		Name	So or aqueous solution		sulfuric (acid)		solid			silver nitrate			nitric (acid)		solid/ aqueous/ solution	correct formulae silver ethanoate		5
Salt made	Acid used			Metal compound																		
		Name	So or aqueous solution																			
	sulfuric (acid)		solid																			
		silver nitrate																				
	nitric (acid)		solid/ aqueous/ solution																			
(b)	$\text{H}_2\text{SO}_4 \rightarrow \text{H}^+ + \text{HSO}_4^- / \text{H}_2\text{SO}_4 \rightarrow 2\text{H}^+ + \text{SO}_4^{2-}$ <p>M1 - formula of both ions correct M2 - balanced equation</p>	H_3O^+ in place of H^+		2																		

Question Number	Answer	A	Reject	Marks
6 (c)	<p>M1- dissolve both (lead(II) nitrate and sodium chloride) in water</p> <p>penalise M1 is any other reagents added</p> <p>M2- mix/add (the two solutions)</p> <p>M3 – filter</p> <p>M4 - wash <u>residue/solid/lead ((II)) chloride</u> (with deionised/distilled water)</p> <p>M5 - dry on filter paper/in a (warm) oven/leave to dry /heat</p>	<p>dissolve one in water</p> <p>react</p> <p>decant</p> <p>other sensible methods of drying</p>	 <p>strong heating</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>
			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)	$\text{Pb}^{2+} + \text{SO}_4^{2-} \rightarrow \text{PbSO}_4$ 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
	filter paper / kitchen roll / blotting paper / absorbent paper / leave (to dry) / (place in) desiccator / (place in warm) oven / heat			1
	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