Mark scheme

Preparation of salts

Chemistry 0620 · Questions from Paper 4 and Paper 6

Total marks

88

MARKS FOR EACH QUESTION

1	2	3	4	5	6	7	8	9	10	Total
6	8	6	6	6	6	10	10	15	15	**88**

Question 1 [6]

1 **(a)** to speed up the reaction [1]

(b) solid visible owtte e.g. no more solid will dissolve [1]

(c) filtration / centrifuge **not** decant [1]

(d) to make sure water (of crystallisation) is not lost / stop dehydration /
so crystals do not turn into powder / does not decompose **not** crystals break [1]

(e) no heat needed / not necessary to warm acid (1)
carbonates react with acid at room temperature (1)
no bubbles would indicate that carbonate is in excess (1) [max 2]

[Total: 6]

Question 2 [8]

2(a)	**A** glass / stirring rod	**1**
	B (conical) flask	**1**
2(b)	filtration	**1**
2(c)	filtrate	**1**
2(d)	step 4: wash / rinse (with water)	**1**
	to remove sodium sulfate / sodium chloride	**1**
	step 5: dry	**1**
	water	**1**

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Question 3 [6]

3	**making the salt** any 4 from: • known volume sulfuric acid; • add named indicator; • add potassium hydroxide solution to the acid until the indicator changes colour / is neutralised; • note / measure the volume of potassium hydroxide solution added; • repeat without indicator **OR** add (decolourising) charcoal; **obtaining crystals** any 2 from: • heat / evaporate solution to crystallising point until half evaporated **OR** until crystals (start to) form **OR** until saturated; • leave to cool; • filter to get crystals; • dry crystals (on filter paper) / leave to dry;	6

Question 4 [6]

4	**any 6 from** **MP1** adds cobalt(II) oxide to (dilute) sulfuric acid in a suitable container	6
	MP2 cobalt(II) oxide is in excess	
	MP3 the mixture is stirred / mixed	
	MP4 the acid / mixture is heated/warmed	
	MP5 filter (to remove (excess) cobalt(II) oxide)	
	MP6 heat filtrate / solution / leave to evaporate (reject heat to dryness)	
	MP7 filter out crystals / **description** of drying crystals	

Question 5 [6]

5	any 6 points from: • add sodium chloride / lead nitrate to water • stir / mix / shake (to dissolve) • add / combine / mix the two reactants together • use of a suitable container • filter (to obtain lead(**II**) chloride as residue) • pour water over the residue (in the funnel) • description of how to dry the solid	6

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Question 6 [6]

6	any 6 from: • weighed sample / stated mass (e.g. 5 g) / known mass of epsomite • in a crucible • heated (strongly using a Bunsen burner / spirit burner) • reweigh • heat again, reweigh, continue until mass stops changing • calculate mass of water lost by original mass – final mass • calculate percentage water by 100 × mass water / original mass	**6**

Question 7 [10]

7(a)	method A; hydrochloric acid / HC*l* / hydrogen chloride solution; nickel carbonate + hydrochloric acid → nickel chloride + water + carbon dioxide;	**3**	hydrochloric acid / HC*l* can only score if written in the reagent space i.e. **R** hydrochloric acid / HC*l* in equation if reagent space is blank **I** hydrogen chloride (therefore 'hydrogen chloride + HC*l*' would get mark 2 BOD) **I** nickel carbonate **A** fully correct balanced chemical equation i.e. $NiCO_3 + 2HCl \rightarrow NiCl_2 + CO_2 + H_2O$ for the third mark **R** combination of words and formulae in the same equation for the third mark **I** concentration of acid for marks 2 and 3
7(b)	method C; any (aqueous / dilute / solution of soluble) bromide including potassium bromide / KBr, hydrogen bromide / HBr i.e. all bromides except silver, lead and mercury; $Pb^{2+} + 2Br^- \rightarrow PbBr_2$;	**3**	**A correct** formula of soluble bromide **I** lead nitrate **I** state symbols **A** multiples
7(c)	method B; sulfuric acid / hydrogen sulfate / H_2SO_4 ; $2LiOH + H_2SO_4 \rightarrow Li_2SO_4 + 2H_2O$ species; balancing;	**4**	**I** concentration of acid for mark 2 **I** indicators / lithium hydroxide **I** state symbols **A** multiples

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Question 8 [10]

8 **(a)** **(i)** add carbon / animal charcoal [1]
filter [1]

OR

repeat experiment without indicator [1]
using same quantity / volume of acid [1]

(ii) add magnesium metal / carbonate / oxide / hydroxide
to (hot) (hydrochloric) acid [1]

cond: until in excess **or** no more dissolves **or** reacts [1]

cond: filter (to remove unreacted solid) [1]

(b) number of moles of HC*l* = 0.020 x 2.20 = 0.044 [1]
number of moles of LiOH = 0.044
concentration of LiOH = 0.044/0.025 = 1.769 (mol / dm^3) [1]
accept 1.75 to 1.77 need 2 dp
correct answer scores = 2

(c) (for LiC*l*.$2H_2O$)
mass of one mole = 78.5 [1]
percentage water = 36 / 78.5 x 100 [1]
45.9 so is LiC*l*.$2H_2O$ [1]
only award the marks if you can follow the reasoning and it gives 45.9% of water

note: if correct option given mark this and ignore the rest of the response

allow: max 2 for applying a correct method to another hydrate, [1] for the method and [1] for the correct value, working essential

[Total: 10]

Question 9 [15]

9(a)	(add) **water** (to both salts) (1) **dissolve** both salts / make **solutions** (1) **filter** (lead(II) iodide)(1) wash (residue of lead(II) iodide) with **water AND dry** e.g. with filter paper / description of washing and drying (1) $Pb(NO_3)_2 + 2\ NaI \rightarrow 2NaNO_3 + PbI_2$ **OR** $Pb^{2+} + 2I^- \rightarrow PbI_2$ (1)	**5**
9(b)(i)	glowing splint (1) relights / rekindles (1)	**2**
9(b)(ii)	**2**ZnO(s) **and 4**NO2(g) (1) **12**H2O(g) (1)	**2**
9(c)(i)	**heat** again **and weigh** again / repeat steps 2 and 3 (1) until mass is constant (1)	**2**
9(c)(ii)	0.005 (1) 0.9 (1) (0.9 ÷ 18 =) 0.05 (1) (0.05 ÷ 0.005 =) 10 (1)	**4**

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Question 10 **[15]**

10 **(a)** **(i)** to neutralise all the acid / so all acid reacts [1]
not: reaction goes to completion

(ii) remove excess carbonate / removes unreacted carbonate [1]
not: remove solid

(iii) need water of crystallisation / hydrated crystals / to get crystals [1]

(iv) filter / decant / wash crystals [1]
dry with filter paper or tissues etc. [1]
accept: in warm oven / warm place / in sun
not: just heat

(b) **(i)** potassium carbonate is soluble / both salts soluble [1]

(ii) use potassium carbonate solution [1]
accept: implication of solution – in pipette / burette / 25 cm^3
titrate / titration term required [1]
use an indicator **accept:** any named acid/base indicator [1]
repeat without indicator / use carbon to remove indicator [1]

(c) mass of hydrated magnesium sulfate = 1.476 g
mass of barium sulfate formed = 1.398 g
the mass of one mole of $BaSO_4$ = 233 g
the number of moles of $BaSO_4$ formed = 0.006 [1]
the number of moles of $MgSO_4.xH_2O$ used in experiment = 0.006 [1]
the mass of one mole of $MgSO_4.xH_2O$ = 1.476/0.006 = 246 g [1]
the mass of xH_2O in one mole of $MgSO_4.xH_2O$ = 246 – 120 = 126 g [1]
x = 126/18 = 7 [1]
if x given without method = max 1
note: apply ecf but x must be an integer and less than 10

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