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MARKING GUIDE FOR 545/3 CHEMISTRY 2020

STION	MARKS AWARDED FOR	MA
30 marks		
1.	Volume of pipette used 20.0 cm^3 ✗	½

Final burette reading (cm^3)	14.50	14.60	29.00
Initial burette reading (cm^3)	0.00	0.00	14.60
Volume of BA1 used (cm^3)	14.50 ✓	14.60 ✓	14.40 ✓

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(a) (i) Volumes of BA1 used to calculate the average

14.50, 14.60, 14.40 cm^3 ✓ 1

(ii) Average volume of BA1 used

$$\frac{14.50 + 14.60 + 14.40}{3}$$

$= 14.50\ cm^3$ ✓✓✗ 2

QUESTION | MARKS AWARDED FOR

1 (b) Calculate the

(i) number of moles of hydrochloric acid that reacted

$1000\ cm^3$ of the acid contain 0.1 moles ✓

$14.50\ cm^3$ of the acid contain $\frac{0.1 \times 14.50}{1000}$ moles ✓

$= 1.45 \times 10^{-3}$ moles ✓

(ii) number of moles of potassium hydrogencarbonate that reacted with the hydrochloric acid

Since 1 mole of the acid reacts with 1 mole of the hydrogen-carbonate ✓

Moles of the hydrogen carbonated reacted $= 1.45 \times 10^{-3}$ moles ✓

(iii) concentration of potassium hydrogencarbonate in moles per dm^3 in BA2

$20.0\ cm^3$ of BA2 contain 1.45×10^{-3} moles of the hydrogencarbonate ✓

$1\ dm^3$ ($1000\ cm^3$) will contain $\frac{1.45 \times 10^{-3} \times 1000}{20.0}$ moles ✓

$= 0.0725M$ ✓

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(c) Determine the percentage purity of the potassium hydrogencarbonate

1 mole of $KHCO_3$ weighs $39+1+12+(3\times16)$ g ✓

$= 100$ g ✓

$\therefore$ 0.0725 moles of $KHCO_3$ weigh 0.0725×100 g ✓

$= 7.25$ g ✓

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Percentage purity of the $KHCO_3$ $= \frac{7.25 \times 100}{10.0}$ % ✓

$= 72.5$ % ✓

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MARKS AWARDED FOR

TESTS	OBSERVATIONS	DEDUCTIONS
(a) Heat T	Colourless gas ✓ evolved, which turned blue litmus paper red ✓ and lime water milky ✓	CO_2 ✓ evolved $\therefore CO_3^{2-}$
	The residue was yellow ✓ when hot and white ✓ when cold	ZnO ✓ formed $\therefore Zn^{2+}$ ✓ suspected
(b) Add $HNO_{3(aq)}$	Effervescence/Colourless gas ✓ evolved which turned blue litmus paper red ✓ and lime water milky ✓ A colourless solution formed.	CO_2 ✓ evolved $\therefore CO_3^{2-}$ ✓ CONFIRMED
Add $NaOH_{(aq)}$	White ppt ✓ insoluble ✓ in excess NaOH	Ca^{2+} ✓, Mg^{2+} ✓ suspected.
Filter	~~White residue~~ Colourless filtrate ✓	Al^{3+}, Pb^{2+}, Zn^{2+} ✓

NOS	MARKS AWARDED FOR			MARK
	TESTS	OBSERVATIONS	DEDUCTIONS	
2	(c) Add $HNO_{3(aq)}$	A white ppt ✓ dissolved ✓ to give a colourless solution	Al^{3+}, Pb^{2+}, Zn^{2+} ✓	2
	(i) Add $NaOH_{(aq)}$	White ppt ✓ soluble ✓ in excess sodium hydroxide solution.	Amphoteric hydroxide formed Al^{3+} ✗ Pb^{2+} ✗ Zn^{2+} ✗	2½
	(ii) Add $KI_{(aq)}$	No apparent change ✓	Pb^{2+} absent ✓ ∴ Al^{3+} ✓, Zn^{2+} ✓ suspected	2
	(iii) Test of own choice Aqueous ammonia was added ✓ dropwise until in excess	A white ppt ✓ soluble ✓ in excess aqueous ammonia	$Zn(OH)_2$ formed followed by $[Zn(NH_3)_4]^{2+}$ ✓ Zn^{2+} CONFIRMED	2½

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MARKS AWARDED FOR			MARKS
TESTS	OBSERVATIONS	DEDUCTIONS	
(d) Wash residue Dissolve in $HNO_3(aq)$	Residue dissolved in the acid to a colourless solution ✓	Ca^{2+} and Mg^{2+} ✓	1
(i) Add $NaOH(aq)$	White ppt ✓ insoluble in excess sodium hydroxide	Ca^{2+} or Mg^{2+}	2
(ii) Add $NH_3(aq)$	No observable change ✓	Ca^{2+} ✓ CONFIRMED	1

(e) (i) The cations in T are Zn^{2+} ✓
Ca^{2+} ✓ — 1½

(ii) The anion in T is CO_3^{2-} ✓

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