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GCE

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Chemistry (6243/02)

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Mark Scheme (Results)

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1	**P** is calcium hydroxide / $Ca(OH)_2$ **(1)** *ALLOW* limewater **Q** is (potassium) chromate((VI))/dichromate ((VI))/K_2CrO_4/CrO_4^{2-} **(1)** **R** is silver nitrate/ $AgNO_3$**(1)** **S** is zinc/Zn *OR* aluminium/Al *OR* Devarda's Alloy **(1)**			**(4 marks)**
				(Total 4 marks)
2	(a)	(i)	**Cations (2)** Ca^{2+} Sr^{2+} Ba^{2+} Ra^{2+} } *Any two, max (1) if two correct names given* **Anion (1)** NO_3^- NOT name *If charges omitted penalise only once*	**(3 marks)**
		(ii)	NO_2 / nitrogen dioxide	**(1 mark)**
	(b)		Flame test **(1)** Observation — Inference Red/Scarlet/ Crimson — Sr^{2+} Green/ apple-green/ yellow-green — Ba^{2+} Brick red/yellow-red/orange-red — Ca^{2} Deep red/dark red — Ra^{2+} **(2)** If comparison of Ca^{2+} etc. with Ba^{2+}, any 'red' colour is acceptable *OR* to distinguish between Ca^{2+} and either of Sr^{2+} or Ba^{2+} test: add NaOH(aq) **(1)** Obs: no ppt — no ppt — white ppt with excess Inf: Sr^{2+} — Ba^{2+} — Ca^{2+} **(2)** *Mark consequently on group 2 ions in (a)(i)*	**(3 marks)**
				(Total 7 marks)

3	(a)	Bromine/Br *NOT* bromide / Br^- *NOT* Br_2	**(1 mark)**
	(b)	KOH / NaOH *OR* words ALLOW OH^- *IGNORE references to solvent*	**(1 mark)**
	(c)	OH/hydroxyl group/alcohol *NOT* hydroxide	**(1 mark)**
	(d)	C=C/carbon-carbon double bond *ALLOW* alkene	**(1 mark)**
	(e)	$CH_3CH_2CH_2Br$ *OR* $CH_3CHBrCH_3$ *OR* $CH_3CH_2CH_2X$ *OR* CH_3CHXCH_3 **(1)** $CH_3CH_2CH_2OH$ *OR* $CH_3CH(OH)CH_3$ **(1)** *The alcohol must follow from the halogenoalkane in terms of 1^o / 2^o* $CH_2 = CHCH_3$ **(1)** *double bond must be shown – stand alone* *OR* full structural formulae	**(3 marks)**
			(Total 7 marks)

4	(a)	Two intersecting straight lines through data		**(1 mark)**
	(b)	(i)	27.0 cm^3 *ALLOW* $\pm$ 1.0 cm^3	**(1 mark)**
		(ii)	9.3 $\pm$ 0.5 ^oC	**(1 mark)**
	(c)	(i)	$\frac{(b)(i) \times 2}{1000}$ *ALLOW correct answer with no working*	**(1 mark)**
		(ii)	(c)(i)	**(1 mark)**
		(iii)	(c)(ii) x $\frac{1000}{50}$ **(1)** *Correct answer – see table below* **(1)**	**(2 marks)**
	(d)	(i)	50 + (b)(i) **(1)** x 4.2 x $\frac{(b)(ii)}{(1000)}$ = answer **(1)** *Must use (b)(i) in calculation to score 2nd mark* *If the units are given, they must be correct*	**(2 marks)**
		(ii)	ΔH = – $\frac{(d)(i)}{0.05 \times (c)(iii)}$ = answer plus units sign **(1)** numerical answer, using candidate's figures, to 2 or 3 s.f. **(1)** kJ mol^{-1} **(1)** *can be in J or KJ*	**(3 marks)**
		Table of answers		
	(e)	Insulate calorimeter / (polystyrene) cup OR put (calorimeter) in a (glass) beaker *OR* put a lid on		**(1 mark)**
				(Total 13 marks)

(b)(i)	(b)(ii)	(c)(i) & (ii)	(c)(iii)	(d)(i) / kJ	(d)(ii) / kJ mol^{-1}
26.0	9.4 9.6	0.052	1.04	3.00 3.06	- 57.7 - 58.8
26.5	9.4 9.6	0.053	1.06	3.02 3.08	- 57.0 - 58.1
27.0	9.4 9.6	0.054	1.08	3.04 3.10	- 56.3 - 57.4

5	(a)	(i)	Reaction takes time *OR* reaction is slow / activation energy is high *OR* to speed up the reaction / supplies activation energy *Answer could be covered in (ii) allow mark provided the answer in (i) is sensible.*	**(1 mark)**
		(ii)	(Without a reflux condenser the volatile) substances/the ester could be boiled off.	**(1 mark)**
	(b)	Any flask and any source of heat **(1)** *ALLOW* "Heat" *Flask must be connected to the rest of the apparatus* *ALLOW flask & condenser as one piece of apparatus* vertical condenser **(1)** water flow **(1)** consequential on a vertical condenser apparatus not closed **(1)** consequential on a vertical condenser		**(4 marks)**
	(c)	(i)	To convert it into benzoic acid *OR* to liberate the acid (from the salt) *OR* a description of the chemistry	**(1 mark)**
		(ii)	Because the acid is soluble in hot water *OR* the acid is insoluble in cold water *OR* to crystallise out the acid	**(1 mark)**
	(d)	(i)	Amount of ester = 4.5 ÷150 = 0.03 (mol) **(1)** Amount of product = 2.93 ÷122 = 0.024 (mol) **(1)** % yield = $\frac{0.024 \times 100}{0.03}$ = 80 % **(1)** *OR* 150 g ester => 122 g acid **(1)** 4.5 g => $\frac{4.5 \times 1.27}{150}$ = 3.66 g **(1)** $\frac{2.93 \times 100}{3.66}$ = 80 % **(1)** $\frac{2.93}{4.5} \times 100$ **(0)**	**(3 marks)**
		(ii)	Lowered because more stays in solution *OR* Lowered because some stays in solution	**(1 mark)**
	(e)	PCl_5 reacts with water		**(1 mark)**
				(Total 14 marks)

6 QWC	Heat solids No brown gas/NO_2 – $RbNO_3$ **(1)** Brown gas/ NO_2 – $LiNO_3$ or $Sr(NO_3)_2$ **(1)** Make solution (in water) **(1)** Add **solution** of NaOH / Na_2SO_4 / Na_2CO_3 H_2SO_4 **(1)** (White) ppt means $Sr(NO_3)$ **(1)** No ppt, $LiNO_3$ **(1)**	*OR* Make solution (in water) **(1)** Add **solution** of NaOH / Na_2SO_4 / Na_2CO_3 / H_2SO_4 **(1)** (White) ppt – $Sr(NO_3)$ **(1)** No ppt with other two **(1)** Heat other two $LiNO_3$ → O_2+NO_2 **(1)** $RbNO_3$ → O_2 only **(1)**	**(6 marks)**
	ALLOW marks for correct tests for strontium and lithium if water omitted (**max 5**) *"Make solution" mark is stand alone provided what follows makes some sense.* *If suggest heat and measure time for O_2 to be produced* (**max 2**) *Equations can score action of heat marks.* *There is no mark for describing the test for oxygen.* *QWC* *Plan must be a process of elimination. If candidate assumes they know which is which and then prove it correctly* (**max 5**)		
			(Total 6 marks)
			TOTAL FOR PAPER: 50 MARKS