

MARKING SCHEME

TABLE I

	I	II	III
Final burette reading (cm ³)	25.0	25.0	35.0
Initial burette reading (cm ³)	0.0	0.0	10.0
Volume of solution A used (cm ³)	25.0	25.0	25.0

Complete table (converted) √1

Correct arithmetic √1

Decimal place √1

Consistency √1

Accuracy √1

5m

(ii) Average volume of solution A used

$$\frac{25.0 + 25.0 + 25.0}{3} \quad \sqrt{1/2} \quad = 25.0\text{cm}^3 \quad \sqrt{1/2}$$

(b) (i) Moles of HCl used = $0.1 \times \frac{25}{1000}$

$$= 0.0025 \text{ mol} \quad \sqrt{1/2}$$

Moles ratio of acid : $\text{B}_2\text{X} \cdot 10\text{H}_2\text{O} = 2 : 1 \quad \sqrt{1/2}$

∴ Moles of $\text{B}_2\text{X} \cdot 10\text{H}_2\text{O}$ used = $\frac{1}{2} \times 0.0025 \quad \sqrt{1/2}$

$$= 0.00125 \text{ mol} \quad \sqrt{1/2}$$

(ii) 25cm^3 of $\text{B}_2\text{X} \cdot 10\text{H}_2\text{O}$ contains 0.00125 mol

1000cm^3 of $\text{B}_2\text{X} \cdot 10\text{H}_2\text{O}$ contains $\frac{100}{25} \times 0.00125 \quad \sqrt{1}$

$$= 0.05\text{M} \quad \sqrt{1}$$

Penalise $\frac{1}{2}$ m for missing or wrong units

This paper consists of 4 printed pages

Turn Over

(iii) 0.05 mol of $\text{B}_2\text{X} \cdot 10\text{H}_2\text{O}$ weighs 19.1g $\sqrt{1/2}$

$$1 \text{ mol of } \text{B}_2\text{X} \cdot 10\text{H}_2\text{O} \text{ weighs } \frac{1}{0.05} \times 19.1 \quad \sqrt{1/2}$$

$$\text{R.F.M of } B_2X \cdot 10H_2O = 382 \sqrt{1} = 382g$$

Penalise ½ m if units are used

$$\begin{aligned} \text{(iv) } B_2X \cdot 10H_2O &= 382 \sqrt{1/2} \\ 2B + 156 + 180 &= 382 \sqrt{1/2} \\ 2B &= 382 - 336 \\ 2B &= 46 \sqrt{1/2} \\ B &= 23 \sqrt{1/2} \end{aligned}$$

2. (a) TABLE II

Final temperature ($^{\circ}C$)	
Initial temperature ($^{\circ}C$)	

Complete table $\sqrt{1/2}$
Trend and accuracy $\sqrt{1/2}$

$$\text{(ii) } \Delta T_1 = \text{Final temperature} - \text{initial temperature} = \text{-ve value}$$

$$\begin{aligned} \text{(b) (i) } \Delta H &= MC\Delta T \\ &= \frac{30 \times 4.2 \times \Delta T_1}{1000} \\ &= \text{+ve value in kJ} \end{aligned}$$

Penalize ½ m for missing or wrongly written units

$$\begin{aligned} \text{(ii) } 1 \text{ mol of } H_2C_2O_4 \cdot 2H_2O &= 126g \sqrt{1/2} \\ \therefore 2g \text{ of } H_2C_2O_4 \cdot 2H_2O &= \frac{2 \sqrt{1/2}}{126} \times 1 \sqrt{1/2} \\ &= 0.015873 \text{ mol } \sqrt{1/2} \end{aligned}$$

(iii) 0.015873 mol of acid absorbs kJ in (b) (i) above

$$\begin{aligned} 1 \text{ mol of acid absorbs } &1 \text{ x kJ in b(i)} \\ &\frac{0.015873 \sqrt{1/2}}{0.015873} \\ &= \text{+ve value in } kJmol^{-1} \sqrt{1/2} \end{aligned}$$

Penalize the ½ m for answer if units are missing or wrongly written.

2.

TABLE III

(c) (i)

Temperature of solution D, T_1 ($^{\circ}C$)	
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Temperature of solution E, T ₂ (°C)	
Initial temperature T ₁ + T ₂ (°C)	
2	
Final temperature of mixture (°C)	

Complete table = 1 mark

Trend and accuracy = 1 mark

(ii) $\Delta T_2 = \text{Final temperature} - \text{initial temperature} = +\text{ve value } ^\circ\text{C} \checkmark 1$

(d) (i)
$$= \frac{\Delta H = MC\Delta T}{1000} \checkmark 1$$

$$= \frac{60 \times 4.2 \times \Delta T_2}{1000}$$

$$= -\text{ve value of kJ}$$

 Penalize ½ mark if units are missing or wrongly written.

(ii) Moles of oxalic acid in solution D used

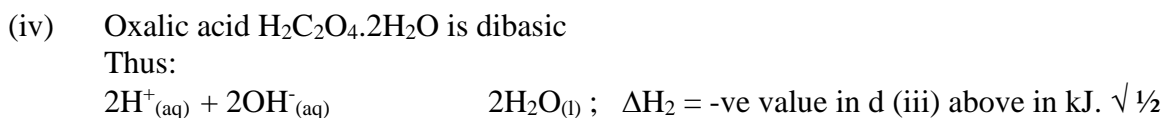
$$= \frac{30 \times 0.5}{1000} \checkmark 1/2$$

$$= 0.015 \text{ mol } \checkmark 1/2$$

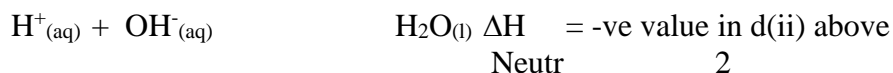
(iii) ΔH_2 (Heat of reaction of one mole of oxalic acid with sodium hydroxide)

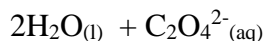
$$= \frac{1 \checkmark 1/2 \times \text{volume} - \text{d(i) above}}{0.015}$$

$$= -\text{ve value of kJ. } \checkmark 1/2$$



Hence





$$\Delta H_3 = \Delta H_1 + \Delta H_2 \quad \checkmark 1$$

$$= -\text{ve value in kJ} \quad \checkmark 1$$

Penalize 1/2 mark if units are missing or wrongly written.

3.	(a)	OBSERVATIONS	INFERENCEs
	-	Colourless gas evolved with pungent chocking smell $\checkmark 1/2$	- Gas evolved in basic $\checkmark 1/2$
	-	Gas turns red litmus paper blue $\checkmark 1/2$	- NH_3 gas evolved $\checkmark 1/2$
	-	Blue litmus paper remains blue $\checkmark 1/2$ (1 1/2 marks)	(1 mark)
	(b)		
	-	Burns with a golden yellow flame. $\checkmark 1$	Na^+ ions present $\checkmark 1$
		(1 mark)	(1 mark)
	(c)		
		Purple acidified \checkmark KMnO_4 decolorised	SO_3^{2-} ions present $\checkmark 1/2$ / presence of a reducing agent $\checkmark 1$
		Rej. Colour disappears	
		Colourless solution formed (1 mark)	(1 1/2 marks)
	(d)		
		White precipitate formed $\checkmark 1/2$ which dissolves in dilute HCl acid. $\checkmark 1/2$	SO_3^{2-} ions present $\checkmark 1$
		(1 mark)	(1 mark)