

CHEMISTRY PAPER 3
MARKING SCHEME

1. Table 1

Time (min)	0	½	1	1½	2	2½	3	3½	4	4½	5	5½	6
Temperature (°C)		25.0		25.0	35.0	29.0	34.0	36.0	37.0	36.5	36.0	36.0	36.0

3 marks for correct values
2 ½ marks for 10 correct values
2 marks for 9 correct values
1 ½ marks for 8 correct values
1 mark for 7 correct values
0 mark below 7 correct values

Values must have trend increase – apex – drop

a) $\text{Mg}_{(s)} + \text{H}_2\text{SO}_{4(aq)} \rightarrow \text{MgSO}_{4(aq)} + \text{H}_{2(g)}$
1 marks for correct, in IUPAC conformations balanced, correct state symbols

Penalize ½ if no/missing state symbols or wrong state symbols

Zero if it doesn't conform to IUPAC letters joined / capital letters instead small letters and vice versa

b) $\text{Mg}_{(s)} + 2\text{H}^+_{(aq)} \rightarrow \text{Mg}^{2+}_{(aq)} + \text{H}_{2(g)}$
1 mk correct, conforms to IUPAC, correct state symbols, balanced.

Not balanced zero / doesn't conform to IUPAC zero

c) Highest change in temperature

$$\Delta T = 37 - 25 \checkmark \frac{1}{2} = 12^\circ\text{C} \checkmark \frac{1}{2}$$

d) $50\text{g} \times 4.2\text{Jg}^{-1} \times 12^\circ\text{C} = 2520\text{J} \checkmark^1$

Penalize ½ - if units not shown / wrong
- answer is missing

e) 1 mole $\rightarrow 323000\text{Jmol}^{-1} \checkmark \frac{1}{2}$

$$x \text{ mole} \rightarrow 2520\text{J}$$

$$\frac{2520\text{J} \times 1 \text{mol}}{323000 \text{Jmol}^{-1}} \checkmark^1 = 7.80 \times 10^{-3} \text{ mole/J} \checkmark \frac{1}{2}$$

$$x = \frac{2520\text{J} \times 1 \text{mol}}{323000 \text{Jmol}^{-1}} \checkmark^1 = 7.80 \times 10^{-3} \text{ mole/J} \checkmark \frac{1}{2}$$

Moles of $\text{H}_2\text{SO}_4(p) = 0.0078$ moles

Penalize ½ if units are wrong / missing or the candidates ends at division part only

f) Conc of H_2SO_4 or solution M

$$\frac{\text{moles}}{\text{vol (l)}} = \frac{0.0078}{0.05} = 0.156\text{M} \checkmark^1 (1 \text{ mark})$$

Penalize ½ if units missing or answer is missing or if the answer is rounded off.

Table II

	1	2	3
F.B.R cm^3	18.2	38.1	18.1
I.B.R cm^3	0.00	20.0	00.0
Titre volume	18.2	18.1	18.1

3 mks if it has the following

- Accuracy / penalize values for all columns / rows
- Consistent in sign figures / decimal places

Penalize;

1 mk if values not accurate / penalize by ± 0.2 from each other

½ mk have no consistence in sig figures

½ mk have no league values

½ mk if not subtracted to get titre values.

$$\frac{18.2 + 18.1 + 18.1}{2} \checkmark \frac{1}{2} = 18.13$$

a) $\frac{18.2 + 18.1 + 18.1}{2} \checkmark \frac{1}{2} = 18.10\text{cm}^3 \checkmark \frac{1}{2}$

b) $\text{H}_2\text{SO}_{4(aq)} + \text{NaOH}_{(aq)} \rightarrow \text{Na}_2\text{SO}_{4(aq)} + 2\text{H}_2\text{O}_{(l)}$

1 mark if correct, conforms to IUPAC balanced, correct state symbols.

Penalize ½ if wrong state symbols / missing zero if not balanced, violate IUPAC

c) $2\text{H}^+_{(aq)} + 2\text{OH}^-_{(aq)} \rightarrow 2\text{H}_2\text{O}_{(l)}$

½ mk if correct, state symbols

Or $\text{H}^+_{(aq)} + \text{OH}^-_{(aq)} \rightarrow \text{H}_2\text{O}_{(l)}$

d) Moles = molarity x vol (l)

$$\frac{0.5 \times 18.1}{1000} = 9.05 \times 10^{-3} = 0.00905 \text{ moles} \checkmark^1$$

Penalise ½ if answer is rounded off.

e) i) reaction mole NaOH: $\text{H}_2\text{SO}_4 = 2 : 1 \checkmark \frac{1}{2}$

moles of H_2SO_4 in 25cm^3 of

solution Z = $0.00905 \times \frac{1}{2} \checkmark^1$

$$= 4.525 \times 10^{-3} \text{ moles}$$

$$= 0.004525 \checkmark \frac{1}{2}$$

If mole reaction ratio is missing penalize ½

ii) If $25\text{cm}^3 \rightarrow 0.004525$

$$100\text{cm}^3 \rightarrow ? \quad \checkmark \frac{1}{2}$$

$$\frac{100\text{cm}^3}{25\text{cm}^3} \times 0.004525 = 1.81 \times 10^{-2} \text{ moles}$$

$$= 0.0181 \text{ moles}$$

f) $1.81 \times 10^{-2} \text{ moles} + 7.80 \times 10^{-3} \text{ moles}$

Or

$$0.01810$$

$$+ 0.00780$$

$$0.02590 = 2.59 \times 10^{-2} \text{ moles}$$

g) Conc of H_2SO_4 as solution Z

$$= \frac{\text{moles}}{\text{vol (l)}} =$$

$$25\text{cm}^3 \rightarrow 0.004525$$

$$1000\text{cm}^3 \rightarrow ?$$

$$\frac{0.004525}{25} \times 1000 = 0.181 \text{ moles}$$

$$\text{conc} = \frac{\text{moles}}{\text{vol (l)}} = \frac{0.181}{1} = 0.181\text{M}$$

Penalize ½ if units missing or are wrong

M must be capital, penalize if M is small letter

2.

	Observation	inference
1	Sparingly soluble in cold water but soluble on warming	Partially soluble salt
i	Vigorous effervescence, colourless gas that burns with pop sound	Hydrogen gas produced H^+ ions present // solution is acidic
ii	Vigour effervescence occurs	CO_2 gas produced H^+ ions // acidic solution
iii	Bromine water not decolorized	$\text{C}=\text{C}$, $\text{C}\equiv\text{C}$ absent
iv	Potassium manganate (VII) not decolorized	$\text{C}\equiv\text{C}$ absent
v	pH = S	H^+ ions present (-COOH) acidic present