

**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  $\rightarrow 323000\text{Jmol}^{-1} \checkmark \frac{1}{2}$

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

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

*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  $\text{H}_2\text{SO}_4$  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 $\text{cm}^3$ | 18.2 | 38.1 | 18.1 |
| I.B.R $\text{cm}^3$ | 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  $\pm 0.2$  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  $\text{H}_2\text{SO}_4$  in  $25\text{cm}^3$  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  $\text{H}_2\text{SO}_4$  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  $\frac{1}{2}$  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<br>$\text{H}^+$ ions present // solution is acidic |
| ii  | Vigour effervescence occurs                                      | $\text{CO}_2$ gas produced $\text{H}^+$ 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   | $\text{H}^+$ ions present (-COOH) acidic present                         |

