

4.7.3 Chemistry Practical Paper 3 (233/3)

<p>1 a)</p>	<p>(i) Table 1</p> <table border="1" data-bbox="268 271 1090 450"> <tr> <td>Maximum temperature reached (°C)</td> <td>43.5</td> </tr> <tr> <td>Initial temperature (°C)</td> <td>25.0</td> </tr> <tr> <td>Change in temperature, ΔT_1(°C)</td> <td>18.5</td> </tr> </table> <p>(i) Complete Table-----1 mark Penalize ½ mark for:</p> <ul style="list-style-type: none"> • incorrect subtraction; • maximum temperature less than initial temperature; • Initial temperature < 10°C or > 40°C. <p>(ii) Use of decimal -----1 mark</p> <ul style="list-style-type: none"> • Accept whole numbers or 1 decimal to .0 or .5; • Accept 2 decimal places for .00, .25, .50, .75. <p>(iii) Accuracy -----1 mark Award 1 mark if candidate's initial temperature is within $\pm 2^\circ\text{C}$ of the school value.</p> <p>(ii) I. Moles = $\frac{25 \times 0.5}{1000} \times \frac{1}{2}$ - penalize fully if any other values apart from 25 and 0.5 are used. = <u>0.0125</u>$\frac{1}{2}$ -If units are used, accept moles/mol not mols.</p> <p>II. Enthalpy change = $\frac{-25 \times 4.2 \times 18.5}{0.0125} \text{ Jmol}^{-1} \times \frac{1}{2}$ = <u>-155,400 Jmol⁻¹</u>$\frac{1}{2}$</p> <p style="text-align: center;">OR</p> <p style="text-align: center;">= <u>-155.4 kJmol⁻¹</u> Penalize ½ mark if sign or correct units Jmol/ kJmol</p>	Maximum temperature reached (°C)	43.5	Initial temperature (°C)	25.0	Change in temperature, ΔT_1 (°C)	18.5	<p>(3 marks)</p> <p>(1 mark)</p> <p>(1 mark)</p>
Maximum temperature reached (°C)	43.5							
Initial temperature (°C)	25.0							
Change in temperature, ΔT_1 (°C)	18.5							
<p>b)</p>	<p>Table 2</p> <table border="1" data-bbox="248 1809 1058 1989"> <tr> <td>Maximum temperature reached (°C)</td> <td>37.5</td> </tr> <tr> <td>Initial temperature (°C)</td> <td>24.0</td> </tr> <tr> <td>Change in temperature, ΔT_2(°C)</td> <td>13.5</td> </tr> </table>	Maximum temperature reached (°C)	37.5	Initial temperature (°C)	24.0	Change in temperature, ΔT_2 (°C)	13.5	<p>(3 marks)</p>
Maximum temperature reached (°C)	37.5							
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	<p>(i) Complete table -----1 mark Penalize ½ mark for:</p> <ul style="list-style-type: none"> • incorrect subtraction; • maximum temperature less than initial temperature; • Initial temperature < 10°C or > 40°C. <p>(iii) Use of decimal -----1 mark</p> <ul style="list-style-type: none"> • Accept whole numbers or 1 decimal to .0 or .5; • Accept 2 decimal places for .00, .25 .50, .75. <p>(iv) Accuracy -----1 mark Award 1 mark if candidate's initial temperature is within ± 2 °C of the school value.</p>																	
c)	<p>ΔT_1 is larger/greater than ΔT_2^{v1}</p> <p>Metal B₁ is more reactive than metal B₂ hence greater temperature change.^{v1}</p>	(2 marks)																
d)	<p>Table 3</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>I</th> <th>II</th> <th>III</th> </tr> </thead> <tbody> <tr> <td>Final burette reading</td> <td>22.50</td> <td>12.20</td> <td>24.50</td> </tr> <tr> <td>Initial burette reading</td> <td>10.00</td> <td>0.00</td> <td>12.20</td> </tr> <tr> <td>Volume of Solution C used, cm³</td> <td>12.50</td> <td>12.20</td> <td>12.30</td> </tr> </tbody> </table> <p>(i) Complete table-----1 mark</p> <ul style="list-style-type: none"> • 3 titration done-----1 mark; • 2 titrations done-----½ mark; • 1 titration done -----0 mark. <p>(ii) Use of decimal -----1 mark Accept 1 or 2 decimal displaces used consistently for 1 mark otherwise penalize ½ mark.</p> <p>(iii) Accuracy compared to the school value-----1 mark Award I mark if any value is within ±0.1 of school value if not award ½ mark if any within ± 0.2 otherwise award 0 mark.</p> <p>(iv) Principles of averaging-----1 mark Values averaged must be within ± 0.2 of each other otherwise award 0 mark.</p> <p>(v) Final answer -----1 mark</p> <ul style="list-style-type: none"> • Compare candidate' average volume to school value 		I	II	III	Final burette reading	22.50	12.20	24.50	Initial burette reading	10.00	0.00	12.20	Volume of Solution C used, cm ³	12.50	12.20	12.30	(4 marks)
	I	II	III															
Final burette reading	22.50	12.20	24.50															
Initial burette reading	10.00	0.00	12.20															
Volume of Solution C used, cm ³	12.50	12.20	12.30															

	<p>and award as in accuracy.</p> <ul style="list-style-type: none"> If values were wrongly subtracted, compare the corrected ones with school value and award accordingly. 	
e)	$\text{Average volume} = \frac{12.20 + 12.30}{2} \sqrt{1/2}$ $= 12.25 \text{ cm}^3 \sqrt{1/2}$ $\frac{12.30 + 12.50}{2} \sqrt{1/2}$ $= 12.40 \text{ cm}^3 \sqrt{1/2}$	(1 mark)
f)	<p>i) Moles of potassium manganate(VII) = $\frac{12.25 \times 0.02}{1000} \sqrt{1/2}$</p> $= 2.45 \times 10^{-4} \sqrt{1/2}$ <ul style="list-style-type: none"> penalize 1/2 mark for wrong units used in each case; number of moles given to at least 4 decimal places unless it works out exactly to less than 4 decimal places otherwise penalize 1/2 mark for round off to less than 4 decimal places. <p>ii) Moles of $\text{Fe}^{2+} = 5 \times 2.45 \times 10^{-4} \sqrt{1/2}$</p> $= 1.225 \times 10^{-3} \sqrt{1/2}$ <p>iii) Moles of Fe^{2+} that reacted with $\text{Cu}^{2+} = 1.225 \times 10^{-3} \times \frac{250}{25} \sqrt{1/2}$</p> $= 1.225 \times 10^{-2} \sqrt{1/2}$	(1 mark) (1 mark) (1 mark)
g)	<p>Mass of iron that reacted = $1.225 \times 10^{-2} \times 55.8 \text{ g} \sqrt{1/2}$</p> $= 0.68 \text{ g} \sqrt{1/2}$ <ul style="list-style-type: none"> penalize 1/2 mark for wrong units or missing units. penalize 1/2 mark if mass of iron reacted is greater than 1.5g (because 1.5g of iron was used); penalize 1/2 mark if average value is used for R.A.M apart from 55.8. 	(1 mark)

2. (a)

i.	Test 1	Expected Observations
	To solid K in a boiling tube, add about 10cm ³ dilute nitric(V) acid. Retain mixture for tests 2 & 3. $\sqrt{1/2}$ Test any gas produced using a burning splint. $\sqrt{1/2}$	Effervescence / bubbles of gas or fizzing. $\sqrt{1/2}$ colourless gas extinguishes a burning splint. $\sqrt{1/2}$ Reject : Fizzling, sizzling/hissing
	(1 mark)	(1 mark)
ii.	Test 2	Expected Observations
	To about 2cm ³ of mixture, add aqueous ammonia dropwise until in excess	White precipitate insoluble in excess.
	(1 mark)	(1 mark)
iii.	Test 3	Expected Observations
	To about 2cm ³ of mixture add 2 drops of aqueous sodium sulphate.	White precipitate.
	(1 mark)	(1 mark)

For tests 2 and 3 reject: (i) White / clear solution;

(ii) White precipitate soluble in excess.

NOTE: The order is important $\text{HNO}_3_{(aq)}$ followed by $\text{NH}_3_{(aq)}$ and lastly $\text{Na}_2\text{SO}_4_{(aq)}$. If Na_2SO_4 done before OH^- then it will suggest Ba^{2+} .

General Note on 2(a)

- 1) The order in the note above is very important hence mark the first order and reject fully (award 0 mark) where the tests follow any other order.
- 2) If tests 2 & 3 are interchanged the 2(b) can only be marked put 2b (ii), there being no need for 2b (ii) because absence of Pb^{2+} will already have been identified at 2b (ii).

2. (b)

i.	Test 1	
	Observations	Inferences
	Effervescence, colourless gas extinguishes burning splint.	CO_3^{2-} present. <ul style="list-style-type: none"> • Accept CO_3^{2-} written in words; • Award 0 mark if contradicting ion is mentioned.
	(½ mark)	(½mark)
ii.	Test 2	
	Observations	Inferences
	White precipitate insoluble in excess.	Mg^{2+} , Pb^{2+} present. <ul style="list-style-type: none"> • ammonia is not expected to precipitate Ca^{2+} ions (weak base) • If K was a carbonate aluminium carbonate does not exist.
	(1 mark)	(2 marks)
iii.	Test 3	
	Observations	Inferences
	No white precipitate.	Pb^{2+} absent OR Mg^{2+} present
	(1 mark)	(1 mark)

3. (a)

	Observations	Inferences
	Dissolves to form a colourless solution.	Soluble salt / polar compound.
	(1 mark)	(1 mark)

(b)

i.	Observations	Inferences
	Dissolves, NO effervescence/ No gas bubbles/ No fizzing	-COOH absent RCOOH OR H ⁺ /H ₃ O ⁺ for (½mark)
	(1 mark)	(1 mark)
ii.	Observations	Inferences
	Purple potassium manganate(VII) is decolourised / turns colourless.	$\text{>C=C<} - \text{C} \equiv \text{C} -$, R-OH present.
	(1 mark)	(2 marks)
iii.	Observations	Inferences
	Colour changes from orange to green.	R-OH present.
	(1 mark)	(1 mark)