



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
General Certificate of Education  
Advanced Subsidiary Level and Advanced Level

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**PHYSICAL SCIENCE**

**8780/04**

Paper 4 Advanced Practical Skills

**For Examination from 2011**

SPECIMEN MARK SCHEME

**1 hour 30 minutes**

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**MAXIMUM MARK: 30**

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This document consists of **4** printed pages.



<b>1 (a)</b>	MMO	Correct set up of the circuit without assistance.	
<b>(b)</b>	MMO	$n = 1$ or $2$ and $n = 10$ or $11$ must be included and no more than a gap of three.  $1/V$ increases consistently as $n$ increases (check from graph).  Judge quality of data by scatter of points about the best-fit line (must be 6 sets of readings minimum).	[1]  [1]
	PDO	All columns headed. $V/V (n) (1/V/V^{-1})$ Ignore $n$ column.  All raw data to same precision.  The calculated column correct and $(1/V)$ to same number (or 1 more) of sig. figs.	[1]  [1]  [1]
<b>(c) (i)</b>	PDO	Axes labelled, sensible scales chosen (at least half graph paper used and no awkward scales such as 1:3 or 1:7).  6 points accurately plotted to within half a small square.  Best straight line.	[1]  [1]  [1]
<b>(ii)</b>	ACE	Correct calculation of gradient, using more than half the length of the drawn line. Read-offs must be accurate to half a small square.	[1]
<b>(iii)</b>	ACE	Correct calculation / read-off of the intercept.	[1]
<b>(iv)</b>	ACE	Appropriate uncertainty judged from graph.	[1]
<b>(d)</b>	ACE	Value for $E$ , expect between 4–5 V. Check value is $1/y$ -intercept.	[1]
<b>(e)</b>	ACE	Suitable limitation, e.g. tolerance of resistors, voltmeter reading not steady, voltmeter graduations too large (if relevant) <b>not</b> parallax in reading voltmeter.	[1]
			<b>[Total: 15]</b>

## 2 Supervisor's Report

Check all subtractions in **(a)**. Use the titres, corrected where necessary, to select the "best average" titre to be used as an accuracy standard using the following hierarchy.

- value of 2 identical titres
- average of titres within  $0.05 \text{ cm}^3$
- average of titres within  $0.10 \text{ cm}^3$ , etc.

Calculate, **correct to 2 dp**, the titre if the Supervisor had diluted  $38.50 \text{ cm}^3$  of **solution X**. Do not round calculated averages to nearest  $0.05 \text{ cm}^3$ .

This is given by the expression  $\frac{\text{volume of diluted solution X}}{38.5} \times \text{titre}$

Record this value on the Supervisor's script and on the candidates' scripts against the titration table.

### Candidate scripts

Check and correct all subtractions as above.

Examiner is to select best titre as above, (**do not include values labelled rough unless rough is crossed out or ticked/used by candidate**) and calculate the scaled titre for  $38.50 \text{ cm}^3$  of **solution X**. If no volume of **solution X** diluted has been given, assume candidate has used  $38.50 \text{ cm}^3$ .

Record the value against the titration table and calculate the difference to Supervisor.

<b>(a)</b>	MMO	Give one mark for an initial precipitate formed in each box on addition of NaOH or $\text{NH}_3(\text{aq})$ .	[1]	
	PDO	Give one mark for reporting the solubility / insolubility of any initial precipitate on adding excess reagent.	[1]	
	MMO	Give one mark for green, (dark, dirty or muddy green acceptable but not grey-green) ppt. with <b>P</b> which, in at least one case, turns brown on standing.	[1]	
	MMO	Give one mark for brown, orange-brown, red-brown or rust coloured ppt. with mixture of <b>P</b> and <b>Q</b> .	[1]	
	ACE	Identifies $\text{Fe}^{2+}$ and $\text{Fe}^{3+}$ . <b>Q</b> has acted as an oxidant/oxidising agent/oxidiser	[1]	
			<b>[Total: 5]</b>	
<b>(b)</b>	<b>(i)</b> <b>(ii)</b>	PDO	Tabulates initial and final burette readings and volume added in both tables. Table has correct labels and units ( $\text{cm}^3$ ). <i>Tabulation may be vertical or horizontal.</i> <i>Ignore absence of units.</i> <i>Do NOT award this mark if any final and initial burette readings are inverted or 50 is used as the initial burette reading.</i>	[1]
		PDO	Both burette readings in the dilution table and the final and initial burette readings for all accurate titres in the titration table recorded to the nearest $0.05 \text{ cm}^3$ .	[1]
	<b>(i)</b>	MMO	Follows instructions – dilutes $38.00 \text{ cm}^3$ to $39.00 \text{ cm}^3$ (uncorrected) of solution <b>X</b> .	[1]
	<b>(ii)</b>	MMO	Has at least two uncorrected titres within $0.1 \text{ cm}^3$ . <i>Titre labelled 'rough' may be included.</i>	[1]

(ii)	MMO	Accuracy marks – ranges. Give two marks if difference to Supervisor's value is <b>0.3 cm<sup>3</sup></b> or less. Give one mark <b>only</b> for a difference of <b>0.3 cm<sup>3</sup> to 0.5 cm<sup>3</sup></b> . Give <b>neither</b> mark for a difference greater than <b>0.5 cm<sup>3</sup></b> .	
(iii)	ACE	<i>Working must be shown in this section or the selected titres ticked in the titration table.</i> Candidate selects/calculates appropriate "average" from any titre values within 0.20cm <sup>3</sup> . Candidate is permitted to use a titre labelled "rough" or "trial". Where all titres are given to 1 decimal place the average should be calculated correct to 1 or 2 decimal places. Where any titre is recorded to 2 decimal places, the average should be calculated to 2 decimal places or rounded to the nearest 0.05 cm <sup>3</sup> .	[1]
(iv)	ACE	$\frac{25.0}{1000} \times \frac{3.40}{40.0} = 2.125 \times 10^{-3}$	[1]
(v) (vi)	ACE	$\times \frac{1}{1} \times \frac{250}{\text{titre}}$ correctly evaluated <b>and</b> $\times \frac{1000}{\text{vol diluted}}$ correctly evaluated	[1]
(iv)–(vi)	PDO	Working shown <b>and</b> <b>3</b> or <b>4</b> significant figures given in <b>each answer attempted</b> for sections 1–3. A minimum of two sections attempted is required before this mark can be awarded.	[1]
			<b>[Total: 10]</b>