



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.	[1]
<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]  [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.

(a)	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) (i) (ii)	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]
(i)	MMO	Follows instructions – dilutes $38.00 \text{ cm}^3$ to $39.00 \text{ cm}^3$ (uncorrected) of solution <b>X</b> .	[1]
(ii)	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> .	[2]
(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>