

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

**MARK SCHEME for the May/June 2011 question paper
for the guidance of teachers**

9701 CHEMISTRY

9701/34

Paper 32 (Advanced Practical Skills 2),
maximum raw mark 40

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

- Cambridge will not enter into discussions or correspondence in connection with these mark schemes.

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Page 2	Mark Scheme: Teachers' version	Syllabus	Paper
	GCE AS/A LEVEL – May/June 2011	9701	34

Question	Sections	Indicative material	Mark
1 (a)	PDO Layout	I Volume given for Rough titre and accurate titre details tabulated. <i>Minimum of 2×2 “boxes”.</i>	1
	MMO Collection	II Follows instructions – dilutes 45.50–46.50 cm ³ FB 1 and initial and final burette readings and volume of FB 2 added recorded for each accurate titre (on page 3) <i>Headings should match readings. Ignore units. Acceptable headings: initial/final or 1st/2nd (burette) (reading)/(reading at) start/finish; volume added/used/ titre; or wtte [not “difference”]</i> <i>Do not award this mark if: 50(.00) is used as an initial burette reading; more than one final burette reading is 50.(00); any burette reading is greater than 50.(00)</i>	1
	PDO Recording	III All accurate burette readings (initial and final) recorded to nearest 0.05 cm ³ (Accurate titration & dilution tables) <i>Assess this mark on burette readings only, ignore volumes of FB 1 and FB 2 added</i>	1
	MMO Decisions	IV Has two uncorrected, accurate titres within 0.1 cm ³ <i>Do not consider the Rough even if ticked. Do not award this mark if having performed two titres within 0.1 cm³ a further titration is performed which is more than 0.10 cm³ from the closer of the initial two titres, unless a fourth titration, within 0.1 cm³ of the third titration (or first two) has also been carried out.</i>	1

Round any burette readings to the nearest 0.05 cm³.
Check and correct, if necessary, subtractions in the titre table.
Examiner then selects the “best” titre using the hierarchy:
two identical; titres within 0.05 cm³; titres within 0.1 cm³; etc

Calculate candidate titre $\times \frac{\text{candidate volume added}}{\text{Supervisor volume added}}$

Calculate difference in Supervisor and candidate scaled values and award “quality” marks as below.
[If candidate has not recorded a volume diluted, use 46.00 cm³]

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Question	Sections	Indicative material	Mark	
	MMO Quality	<p>V, VI and VII Award V, VI and VII for a difference from Supervisor within 0.20 cm^3 Award V and VI only for $0.20 < \delta \leq 0.40 \text{ cm}^3$ Award V only for $0.4 < \delta \leq 0.6 \text{ cm}^3$</p> <p>Apply spread penalty as follows: If titres selected (by Examiner) differ 0.60 cm^3 cancel one of the Q marks</p>	1 1 1	[7]
(b)	ACE Interpretation	<p>Calculates the mean, correct to 2 decimal places (third decimal place may be rounded up to the nearest 0.05 cm^3) from any accurate titres within 0.20 cm^3. A mean of exactly .x25 or .x75 is allowed but the candidate may round up to .x3 or .x8 or to the nearest 0.05 cm^3. If ALL burette readings are given to 1 decimal place then the mean can be given to 1 decimal place if numerically correct without rounding. Mean of 24.3 and 24.4 = 24.35 (✓) Mean of 24.3 and 24.4 = 24.4 (✗) Titres to be used in calculating the mean must be clearly shown – in an expression or ticked in the titration table. Allow ecf from subtraction error for titre</p>	1	[1]
(c)	ACE Interpretation PDO Display	<p>I correctly evaluates 1.25×10^{-4} II, III, IV are awarded for the correct expression but with no extra steps or for the correct answer if no working shown. II answer to (i) $\times 2.5$ (3.125 or 3.13×10^{-4}) and answer to (ii) $\times 2$ (6.25×10^{-4}) III Answer to (iii) $\times 250$/mean titre in (b) IV Answer to (iv) $\times 1000$/volume diluted V Working shown in a minimum of 4 steps <i>working must be in the right direction:</i> (i) 0.005×25 (ii) indicate use of mole ratio ($\times 5/2$ or $2/5$) (If iodide used then $\times 5$ or $/5$) (iii) use of $\times 2$ or $\times 1/2$ (If iodide used then $\times 2/2$ not $\times 1$) (iv) answer to (iii) $\times 250$ or (iii)/mean titre (v) answer to (iv) and volume diluted used in denominator (vi) All final answers to steps to 3 or 4 sf (minimum of 3 steps)</p>	1 1 1 1 1 1	[6]
(d)	ACE Interpretation	<p>$(0.06/25) \times 100$ (= 0.24%) and $(0.10/\text{titre in (b)}) \times 100$ (only expressions needed)</p>	1	[1]
			[Total: 15]	

Page 4	Mark Scheme: Teachers' version	Syllabus	Paper
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Question	Sections	Indicative material	Mark	
2 (a)	PDO Recording	I Records volume of FB 6 , t and $1/t$ unambiguously for the four experiments <i>Do not award if t is not to the nearest second</i>	1	
	MMO Decisions	II Correct headings and units: volume (cm^3) or $/\text{cm}^3$ or volume in cubic centimetres/ cm^3 ; time (s) or $/\text{s}$ or time in seconds/s; $1/\text{time}$ (s^{-1}) or $/\text{s}^{-1}$ or $1/\text{time}$ or rate in per second	1	
		III Selects two volumes of FB 6 one between $25\text{--}30\text{ cm}^3$ and one between $35\text{--}40\text{ cm}^3$ and sufficient water to make the solutions up to 45 cm^3 before adding acid or between $30\text{--}35$ and $10\text{--}15$ with corresponding volumes of water.	1	
Examiner corrects any fractional times to the nearest second for 45 cm^3 and 20 cm^3 of FB 6 and calculates t_{20}/t_{45} to 2 dp				
	MMO Quality	Award IV only if $1.90 < t_{20}/t_{45} < 2.60$ Award IV and V if $2.10 < t_{20}/t_{45} < 2.40$	1 1	[5]
(b)	ACE Conclusions	Volume of FB 6 is directly proportional to its concentration (if total volume is constant) or to keep the concentration of FB 5 constant or to keep the depth constant	1	[1]
(c)	ACE Conclusions	Rate of reaction is proportional to concentration of FB 6 (<i>allow directly proportional</i>) or increase in concentration increases rate or $1/t$	1	[1]
(d)	ACE Interpretation	Either shortest time as greatest percentage/fractional error or longest time as greatest uncertainty in judging when printing is obscured	1	[1]
(e)	ACE Improvements	Keep volume of thio/ FB 6 constant, change volume of acid/ FB 5 and (add water to) make total volume constant or use different concentrations of acid/ FB 5 and keep the volume of it and the thio/ FB 6 constant	1	[1]
			[Total: 9]	

Page 5	Mark Scheme: Teachers' version	Syllabus	Paper
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Question	Sections	Indicative material	Mark	
FB 7 is $Al_2(SO_4)_3$, FB 8 is $Zn(NO_3)_2$, FB 9 is $Pb(NO_3)_2$, FB 10 is anhydrous $NaHCO_3$				
3 (a)	PDO Layout	<i>Do not allow a dash for 'no reaction' except for FB 8 with 2nd reagent provided NH_3 obs correct.</i> I Unambiguous layout of all (six minimum unless as above) observations with the two reagents <i>independent of reagents chosen</i>	1	[5]
	MMO Decisions	II Chooses NH_3 and $KI/K_2CrO_4/H_2SO_4/HCl$ (<i>allow sodium/potassium dichromate</i>)	1	
MMO Collection	III three white ppts with NH_3	1		
	IV Three correct obs FB 7: ppt insol in excess NH_3 , FB 8: ppt soluble in excess NH_3 , FB 9: ppt insol in excess NH_3	1		
	V three correct obs for a suitable reagent Expected obs: FB 7 and FB 8 no reaction, no change, no ppt, and FB 9 white or yellow ppt depending on reagent <i>Allow obs mark if $BaCl_2$ used as 2nd reagent: white ppt with FB 7, no ppt with FB 8 and white ppt or no ppt with FB 9.</i> <i>(If three reagents used mark obs for the two specified on 'reagent' line.)</i> <i>If any solutions appear to have been transposed, mark strictly as mark scheme.</i>	1		
(b)	ACE Conclusions	FB 7 contains Al^{3+} /aluminium (ions) as (white) ppt insoluble in excess NH_3 and no reaction with 2 nd reagent FB 8 contains Zn^{2+} /zinc (ions) as (white) ppt soluble in excess NH_3 FB 9 contains Pb^{2+} /lead (ions) as ppt with 2 nd reagent <i>Only penalise missing charge once.</i> <i>If $NaOH$ used as 2nd reagent allow 1st mark if both Al^{3+} & Pb^{2+} specified for FB 7 and FB 9, (FB 8 mark is still available)</i> <i>The evidence for FB 7 and FB 9 may come from a third reagent (if used)</i> <i>For 'transposed' solutions, if conclusions are valid for the obs given, a maximum of 2 marks may be awarded.</i> <i>If $BaCl_2$ used and only white ppt with FB 7 then allow FB 7 as Pb^{2+}. If two (white) ppts both unknowns should be Pb^{2+} or Al^{3+}/Pb^{2+}.</i>	1 1 1	[3]

Page 6	Mark Scheme: Teachers' version	Syllabus	Paper
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Question	Sections	Indicative material	Mark	
(c)	MMO Collection	<p>(i) Steam/water vapour/misty vapour/condensation/droplets of liquid/water or lime water turns milky/cloudy white</p> <p>(ii) (pale) blue/green ppt/solid (<i>ignore effervescence</i>)</p> <p>(iii) effervescence/fizzing/bubbling (<i>ignore any reference to ppt</i>)</p> <p>(iv) white ppt and either effervescence (with acid) or (colourless) solution/ppt or solid dissolves</p> <p>(v) solid/ppt turns black/dark green/ darkens in 2nd box <i>Allow is formed/changes to</i></p>	1 1 1 1 1	[5]
(d)	ACE Conclusions	<p>(i) CO₃²⁻ from limewater turning milky in any part of (c) or fizzing/effervescence with acid <i>Allow SO₃²⁻ from correct obs in (c)(iv)</i></p> <p>(ii) thermal decomposition or loss of water of crystallisation/dehydration (if CO₂ not tested for)</p> <p>(iii) effervescence suggests Al³⁺(aq)/Al₂(SO₄)₃ is acidic or FB 10 contains Ba²⁺ or Pb²⁺ (both needed) if white ppt recorded or CO₂ (produced) as limewater turns milky/cloudy white/forms white ppt or endothermic if cooling noted in (c)(iii)</p>	1 1 1	[3]
			[Total: 16]	