
CHEMISTRY

9701/34

Paper 34 Advanced Practical Skills 2

May/June 2016

MARK SCHEME

Maximum Mark: 40

Published

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Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Page 2	Mark Scheme	Syllabus	Paper
	Cambridge International AS/A Level – May/June 2016	9701	34

Question	Indicative material	Mark	Total
1 (a)	I Initial and final readings and titre value given for rough titre and initial and final readings for two (or more) accurate titrations (minimum of 2 x 2 box)	1	
	II Titre values recorded for accurate titrations and Appropriate headings for the accurate titration table and cm ³ units. <ul style="list-style-type: none"> initial / start burette reading / volume / value final / end burette and reading / volume / value titre or volume / FB3 and used / added unit: / cm³ or (cm³) or in cm³ or cm³ (for each heading) 	1	
	III All accurate burette readings are to the nearest 0.05 cm ³ . <i>Do not award this mark if:</i> <ul style="list-style-type: none"> 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) 	1	
	IV There are two (or more) uncorrected, accurate titres within 0.10 cm ³ <ul style="list-style-type: none"> 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 two initial titres, unless a further titration, within 0.10 cm³ of any other, has also been carried out. Do not award the mark if any “accurate” burette readings (apart from initial 0 cm³) are given to zero dp. 	1	
	V, VI and VII Examiner rounds any accurate burette to the nearest 0.05 cm ³ , checks subtractions and then select the ‘ best ’ titres using the hierarchy: <ul style="list-style-type: none"> two (or more) accurate identical titres, <i>then</i> two (or more) accurate titres within 0.05 cm³, <i>then</i> two (or more) accurate titres within 0.10 cm³, <i>etc.</i> These best titres should be used to calculate the mean titre, expressed to nearest 0.01 cm ³ . Accuracy marks are awarded as shown. Award V, VI and VII for $\delta \leq 0.30$ (cm ³) Award V and VI for $0.30 \text{ cm}^3 < \delta \leq 0.60$ (cm ³) Award V for $0.60 \text{ cm}^3 < \delta \leq 1.00$ (cm ³)	3	[7]

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Question	Indicative material	Mark	Total
(b)	<p>Candidate must take the average of two (or more) titres that are within a total spread of not more than 0.20 cm³. Working must be shown or ticks must be put next to the two (or more) accurate readings selected. The mean should be quoted to 2 dp, rounded to the nearest 0.01.</p> <p>Two special cases where the mean may not be to 2 dp:</p> <ul style="list-style-type: none"> • Allow mean expressed to 3 dp only for 0.025 or 0.075 (e.g. 26.325) • Allow mean if expressed to 1 dp if all accurate burette readings were given to 1 dp and the mean is exactly correct. (e.g. 26.0 and 26.2 = 26.1 is allowed) (e.g. 26.0 and 26.1 = 26.1 is incorrect – should be 26.05.) • Note: the candidate's mean will sometimes be marked as correct even if it is different from the mean calculated by the examiner for the purpose of assessing accuracy. 	1	[1]
(c) (i)	Correctly calculates $n(\text{HCl})$ used = $\frac{0.008 \times (\mathbf{b})}{1000}$	1	[5]
(ii)	Correct use of factors $n(\text{borax}) = 0.5 \times \text{answer (i)}$ and	1	
(iii)	$n(\text{borax}) = 40 \times \text{answer (ii)}$		
(iv)	Correct use of (iii) and 15.5 $M_r = \frac{15.5}{(\text{iii})}$	1	
(v)	Correct expression $x = \frac{(\text{iv}) - 338}{(10.8)}$	1	
	All answers to 3 or 4 significant figures and if answer (v) is attempted it must be an integer	1	
Question 2			[13]

Page 4	Mark Scheme	Syllabus	Paper
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Question	Indicative material	Mark	Total
2 (a)	I Appropriate headings and units for the three balance readings <ul style="list-style-type: none"> (Mass of) crucible (and lid) (Mass of) crucible, (lid) and FB 4 (or “contents before heating”) (Mass of) crucible, (lid) and residue/MgO/contents after heating/FB 4 after heating Unit covering all balance readings and subtracted values if shown: /g, (g), in g or g (for each heading) 	1	[5]
	II Masses recorded <ul style="list-style-type: none"> Mass of FB 4 used was claimed to be between 1.1–1.3 g All balance readings recorded to same number of decimal places (<i>at least one dp</i>) 	1	
	III Mass of FB 4 and of residue <ul style="list-style-type: none"> Mass of FB 4 used, correctly subtracted Mass of residue, correctly subtracted 	1	
	IV and V <ul style="list-style-type: none"> Use corrected values Examiner used corrected values and works out the ratio $\frac{\text{mass of FB 4}}{\text{mass of MgO}}$ to 1 dp for the candidate Accuracy marks are awarded as shown. Award IV if ratio between 1.4–2.5 Award V if ratio between 1.7–2.3	2	
(b) (i)	Correctly calculates $n(\text{MgO})$ <ul style="list-style-type: none"> $\frac{\text{mass of residue}}{40.3}$ <i>Answer must be expressed to 2, 3 or 4 significant figures</i> 	1	[5]
(ii)	Correct use of (i) and mass of FB 4 <ul style="list-style-type: none"> $n(\text{FB 4}) = \frac{\text{answer (i)}}{2}$ $M_r = \frac{\text{mass of FB 4 used}}{\text{no of moles of FB 4}}$ <i>An answer for M_r must be quoted to 2 or more significant figures</i> 	1	
(iii)	M_r calculated from A_r values in Periodic Table = 178.6	1	
(iv)	Correct expression shown $2.5/100 \times M_r$ in (iii) (= 4.5, 4.47, 4.465) or expresses % difference of the two M_r values $= \frac{ (\text{iii}) - (\text{ii}) }{(\text{iii})} \times 100$ or (iii) $\times \frac{97.5}{100} / (\text{iii}) \times \frac{102.5}{100}$ to give range (= 174(.1) – 183(.1))	1	
	Makes a correct statement (support/does not support/yes/no) about the accuracy of the possible formula, explained by whether the experimental M_r value is close to the answer in (iii). <i>Numbers must be quoted or reference made to (ii) and (iii)</i>	1	[5]

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(c) (i)	Improvement Heat (crucible and residue) to constant mass <i>Accept a description of the procedure for the mark</i> or heat more strongly / to a higher temperature or heat for longer so more is decomposed If a 1 dp balance is used allow use a balance weighing to more dp and to reduce % error (in weighing) / give more precise mass	1	[4]
(ii)	Conclusion To find out whether the two experiments are reliable / consistent / concordant or If the experiments do not agree then carry out a 3rd / another expt or If one experiment was inaccurate because it gave a poor M_r value it can be ignored	1	
(iii)	Error is 0.005g or 0.01g (<i>if 2 dp balance was used</i>) (<i>If a 3 dp balance was used, error is 0.0005 or 0.001g</i>) (<i>If a 1 dp balance was used, error is 0.05 or 0.1g</i>)	1	
	% = $100 \times 2 \times \text{error} / \text{mass of FB 4}$ <i>Accept correct expression or correct answer to 2, 3 or 4 significant figures</i>	1	
Question 2			[14]

	FB 5 is BaCl ₂ ; FB 6 is AgNO ₃ ; FB 7 is H ₂ SO ₄ ; FB 8 is NaHCO ₃					
3 (a)	Three correct observations with Mg Three correct observations with NaOH Three correct observations with KI			3		
	<i>test</i>	FB 5	FB 6			FB 7
	Mg	no reaction / no change (ignore few bubbles (on Mg) / gas produced slowly)	grey / black and ppt / solid / coating / deposit or Mg goes black / grey			fizzing / bubbling / effervescence
	NaOH	no change / no reaction / no ppt / (solution) stays colourless <i>Allow white ppt / cloudy white</i> soluble in excess is CON	(dark) brown ppt soluble in excess is CON <i>Allow brown ppt as final colour after a paler shade of brown but not a different colour (e.g. green / yellow / red)</i>			no change / no reaction / (solution) remains colourless / no ppt or temperature rises <i>Allow heat produced but not exothermic</i>
	KI	no change / no reaction / (solution) remains colourless <i>Accept pale yellow solution</i>	(pale) yellow ppt <i>Allow greenish yellow (but not yellowish green)</i> <i>Allow cream-yellow</i>			no change / no reaction / (solution) remains colourless <i>Accept pale yellow solution</i>
FB 5		white ppt	white ppt			
(Mg)			gas / H ₂ (evolved) pops with lighted splint / spill			
Two correct observations with FB 5			1			
Correct hydrogen gas test			1	[5]		

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(b) (i)	Conclusion and reason Cation is silver/Ag ⁺ (allow lead(II) / Pb ²⁺) and Gives yellow precipitate (with iodide ions) or AgI (PbI ₂) produced	1	[4]
(ii)	Both conclusions about FB 5 are correct <ul style="list-style-type: none"> cation – barium/Ba²⁺ anion – chloride/Cl⁻ 	1	
(iii)	FB 7 is sulfuric acid/H ₂ SO ₄	1	
(iv)	Mg + 2H ⁺ → Mg ²⁺ + H ₂	1	
(c) (i)	Any two observations from: <ul style="list-style-type: none"> Condensation/water formed (inside test tube) Steam liberated/hissing/(water) vapour produced/steamy/misty fumes White residue/solid remains white/white solid formed 	1	[4]
	<u>Gas/CO₂</u> turns lime water milky/white precipitate/cloudy white/chalky	1	
(ii)	Any two observations from: <ul style="list-style-type: none"> Fizzing/bubbling/effervescence Reaction is rapid/vigorous Solid dissolves/colourless solution formed (at end) Temperature drops/it gets colder 	1	
(iii)	Both conclusions required <ul style="list-style-type: none"> cation – not known/not transition metal anion – carbonate/CO₃²⁻ or hydrogencarbonate/HCO₃⁻ 	1	
Question 3			