
CHEMISTRY

9701/32

Paper 3 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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Question	Indicative material	Mark	Total
1 (a)	I Appropriate headings and units for <ul style="list-style-type: none">• mass of FB 1• initial and final volumes (of gas).• unit: /g, (g), in g and allow grams/grammes for g and /cm³, (cm³), in cm³ or cm³ (for each heading)	1	[2]
	II Award if candidate volume within appropriate range derived from Supervisor value	1	
(b) (i)	Correctly calculates $\frac{V(a)}{24.0 \times 1000}$	1	[3]
(ii)	Correct expression $\frac{\text{mass Mg in (a)}}{(b)(i)}$	1	
	Both answers in (b) to 2 to 4 significant figures	1	
Question 1	[5]		

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2 (a)	I Initial and final readings and titre value given for rough titre and initial and final readings for two (or more) accurate titrations (<i>minimum of 2 x 2 box</i>)	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 / FA3 and used / added unit: / cm³ or (cm³) or in cm³ or cm³ (for each heading) 	1	
	III All accurate burette readings recorded 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"> <i>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.</i> <i>Do not award the mark if any “accurate” burette readings (apart from initial 0 cm³) are given to zero dp.</i> 	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	

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(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.) <p>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.</p>	1	[1]
(c) (i)	Correctly calculates $n(\text{NaOH}) \frac{0.150 \times \text{(b)}}{1000}$	1	
(ii)	Correctly uses (i) / 2	1	
(iii)	and (ii) × 10		
(iv)	Correctly calculates $1.00 \times 25.0 / 1000 = 0.025(0)$	1	
(v)	Correctly uses (c)(iv) – (c)(iii)	1	
(vi)	Correctly uses $\frac{\text{mass Mg in 1(a)}}{\text{(v)}}$	1	
	All final answers to 3 or 4 significant figures (minimum of four parts must be attempted)	1	[6]

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(d) (i)	<p>(Experiment 1 is less accurate)</p> <p>One set of:</p> <p>Inaccuracy</p> <p>Improvement</p> <p>Inaccuracy</p> <ul style="list-style-type: none"> gas escaped before bung inserted <p>Improvement</p> <ul style="list-style-type: none"> viable means of keeping solid and acid separate before being added (not put on lid faster) e.g. use divided flask use more (excess) of a lower concentration of acid <p>Inaccuracy</p> <ul style="list-style-type: none"> balance imprecise / inaccurate balance <p>Improvement</p> <ul style="list-style-type: none"> use a balance calibrated to more decimal places (owtte) <p>Inaccuracy</p> <ul style="list-style-type: none"> If candidate volume greater than 250 cm³ then allow problem of measuring volume of gas <p>Improvement</p> <ul style="list-style-type: none"> use larger (capacity) measuring cylinder use less / smaller mass Mg 	<p>1</p> <p>1</p>	
(ii)	Correct expression or correctly calculates $\frac{24.3 - 20.8}{24.3} = 14.4\%$	1	[3]
Question 2	[17]		

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FB 5 is Al(s); FB 6 is NaNO ₃ (s); FB 7 is Al ₂ (SO ₄) ₃ (aq); FB 8 is MnCl ₂ (aq);			
3 (a) (i)	FB 5 + HCl: effervescence / fizzing / bubbling gas pops with lighted splint	1 1	
	FB 5 + FB 6 + NaOH: vigorous / violent / exothermic / great / extreme / lots of and effervescence / fizzing / bubbling gas / NH ₃ turns (damp) red litmus (paper) blue	1 1	
	FB 6 + HCl: no reaction / no change / no gas / no ppt and FB 6 + NaOH: no reaction / no change / no ppt	1	
(ii)	FB 5 is Al (allow Zn) and Reason: effervescence / gives H ₂ / NH ₃ in test 1 and / or 2	1	[9]
	FB 6 cation unknown or Ba ²⁺ or NH ₄ ⁺ or any group 1 metal and reason: from no reaction with NaOH	1	
	anion: NO ₃ ⁻ / NO ₂ ⁻ (or both) reason: If NO ₃ ⁻ then NH ₃ with NaOH + Al and no reaction with HCl	1 1	
(b) (i)	Clearly laid out test / observation / conclusion sections Layout has to show clearly where two reagents are used as part of the same test.	1	
	BaCl ₂ / Ba(NO ₃) ₂ and HCl / HNO ₃ AgNO ₃ and NH ₃	1 1	
	FB 7 only + Ba ²⁺ white precipitate and insoluble in HCl or HNO ₃	1	
	FB 8 only + Ag ⁺ white precipitate	1	
	FB 7 = sulfate / SO ₄ ²⁻ (allow from white precipitate with Ba ²⁺) FB 8 = chloride / Cl ⁻ (allow from white precipitate with Ag ⁺)	1 1	

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(ii)	Off-white / light / pale brown / buff / beige precipitate and darkening on standing with FB 8 Ignore observation with FB 7	1	[9]
	FB 8 = Mn ²⁺ / manganese(II) from some correct evidence	1	
Question 3	[18]		