
CHEMISTRY

9701/32

Paper 3 Advanced Practical Skills 2

May/June 2016

MARK SCHEME

Maximum Mark: 40

Published

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 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)	<p>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>)</p>	1	[7]
	<p>II Titre values recorded for accurate titrations and appropriate headings for the accurate titration table and cm³ units.</p> <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	
	<p>III All accurate burette readings recorded to the nearest 0.05 cm³. <i>Do not award this mark if:</i></p> <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	
	<p>IV There are two (or more) uncorrected, accurate titres within 0.10 cm³</p> <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	
	<p>V, VI and VII Examiner rounds any accurate burette to the nearest 0.05 cm³, checks subtractions and then select the ‘best’ titres using the hierarchy:</p> <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> <p>These best titres should be used to calculate the mean titre, expressed to nearest 0.01 cm³.</p> <p>Accuracy marks are awarded as shown.</p> <p>Award V, VI and VII for $\delta \leq 0.30$ (cm³) Award V and VI for $0.30 \text{ cm}^3 < \delta \leq 0.60$ (cm³) Award V for $0.60 \text{ cm}^3 < \delta \leq 1.00$ (cm³)</p>	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 $n(\text{NaOH}) = \frac{0.150 \times (\mathbf{b})}{1000}$	1	
(ii) (iii)	Correctly uses (i) / 2 and (ii) × 10	1	
(iv)	Correctly calculates $1.00 \times 25.0 / 1000 = 0.025(0)$	1	
(v)	Correctly uses (c)(iv) – (c)(iii)	1	
(vi)	Correctly uses $\frac{\text{mass Mg in 1(a)}}{(\mathbf{v})}$	1	
	All final answers to 3 or 4 significant figures (minimum of four parts must be attempted)	1	[6]

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<p>(d) (i)</p>	<p>(Experiment 1 is less accurate) One set of: Inaccuracy 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 1</p>	
<p>(ii)</p>	<p>Correct expression or correctly calculates $\frac{24.3 - 20.8}{24.3} = 14.4\%$</p>	<p>1</p>	<p>[3]</p>
<p>Question 2</p>	<p>[17]</p>		

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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]