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CHEMISTRY

9701/33

Paper 3 Advanced Practical Skills 1

May/June 2016

MARK SCHEME

Maximum Mark: 40

Published

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Page 2	Mark Scheme	Syllabus	Paper
	Cambridge International AS/A Level – May/June 2016	9701	33

Question	Indicative material	Mark	Total
1 (a)	I Two burette readings and titre value given for the rough titre and initial and final burette readings for two (or more) accurate titrations	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 reading / volume / value titre or volume / FA 3 and used / added unit: / cm³ or (cm³) or in 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) there is only one accurate titration. 	1	
	IV There are two 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 0.10 cm³, a further titration is performed which is more than 0.10 cm³ from the closer of the initial two 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 burette readings 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 . Examiner calculates the difference (δ) between the mean titres obtained by the candidate and the Supervisor. Accuracy marks are awarded as shown. Award V, VI and VII for $\delta \leq 0.20$ (cm ³) Award V and VI for $0.20 < \delta \leq 0.40$ (cm ³) Award V, only, for $0.40 < \delta \leq 0.80$ (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 / explanation 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, and be rounded to nearest 0.01 cm³.</p> <p>Two special cases, where the mean need 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 cm³) • Allow mean 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 wrong – should be 26.05) <p>Note: the candidate's mean will sometimes be marked correct even if it was different from the mean calculated by the Examiner for the purpose of assessing accuracy.</p>	1	[1]
(c) (i)	$(1.06/40) \times 4 = 0.106$	1	[5]
(ii)	Correctly calculates $n(\text{NaOH}) = 0.106 \times (25/1000) = 0.00265$ and	1	
(iii)	$n(\text{HCl}) = 0.00265$		
(iv)	concentration FA 3 = $0.00265 \times 1000/(\mathbf{b})$	1	
	concentration FA 2 = concentration FA 3 $\times 10$	1	
	All answers correct to 3 or 4 sf (minimum of 3 parts attempted)	1	
Question 1			[13]
2 (a)	<p>Table for results with</p> <ul style="list-style-type: none"> • Unambiguous headings and correctly displayed units • Balance readings recorded to same no of dp • One or two measuring cylinder readings recorded (does not have to include volume collected) • Unit: / g or (g) or in g (for each heading), allow grams/grammes for g) and / cm³ or (cm³) or in cm³ (for each heading) • Calculates volume of gas/mass FA 4 to 3 sf. 	1	[2]
	Calculated value within 20% of supervisor value	1	
(b) (i)	Correctly calculates	1	
(ii)	<ul style="list-style-type: none"> • $n(\text{gas}) = \text{correct vol gas} \div 24\,000$ to minimum 2 sf and <ul style="list-style-type: none"> • same number of moles of M₂CO₃ 		
(iii)	$M_r = \text{correct mass from (a)} \div (\mathbf{ii})$	1	

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Question	Indicative material	Mark	Total
(iv)	$A_r = (M_r - 60)/2$ to minimum 2 sf	1	[4]
	Group 1 element identified as one with the closest A_r and an explanation e.g <i>as it is the nearest</i>	1	
(c) (i)	% error = $(1 \times 100)/\text{vol gas collected}$ (if only volume collected shown in (a)) or $(1 \times 100)/\text{final reading}$ (when initial reading is zero) or $(2 \times 100)/\text{vol gas collected}$ (if 2 readings)	1	[5]
(ii)	Reason: gas dissolves (in water/solution)/reacts with water/water absorbs CO_2	1	
	Modification: use a gas syringe/saturate water with carbon dioxide/use hot water/use less water in tub/use smaller volume of more concentrated acid/use oil (other non-aqueous solvent) instead of water	1	
	Reason: gas escapes before stopper inserted/stopper not inserted quickly enough.	1	
	Modification: viable means of keeping solid and acid separate before being added/use larger lumps of solid/use more (excess) of a lower concentration of acid	1	
Question 2			[11]

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FA 5 is HCO₂H; FA 6 is CH₃CO₂H; FA 7 is C₂H₅OH; FA 8 is C₆H₁₂O₆; FA 9 is Zn(NO₃)₂·6H₂O;
FA 10 is NaNO₃

3 (a) (i)	FA 5	FA 6	FA 7	FA 8	4
	Fizz / bubbles / effervescence	Fizz / bubbles / effervescence	no change	no change	
	Gas turns limewater milky / cloudy white / white ppt / chalky	Gas turns limewater milky / cloudy white / white ppt / chalky	No reaction / no change	No reaction / no change	
	Silver / black / dark grey and mirror / solid / ppt	No reaction / no change / no silver mirror	No reaction / no change / no silver mirror	Silver / black / dark grey and mirror / solid / ppt	
	Purple to colourless or solution / MnO ₄ ⁻ / manganate (VII) decolourised / disappeared	No reaction or remains / turns purple or pink	Purple to colourless or solution / MnO ₄ ⁻ / manganate(VII) decolourised / disappeared	Purple to colourless or solution / MnO ₄ ⁻ / manganate (VII) decolourised / disappeared	
(ii)	(-)CO ₂ H / carboxylic acid				1
(iii)	(-)CHO / aldehyde / alkanal or alkene / C=C				1
(iv)	Oxidation of organic compound / reduction of MnO ₄ ⁻ / redox or if alkene in (iii) then electrophilic addition				1
(v)	(-)OH / (1° / 2°) alcohol / alkanol / hydroxy or alkene / C=C				1
(vi)	Add Na to give effervescence / hydrogen / gas which pops with lighted splint, or Add PCl ₅ / SOCl ₂ to give misty fumes / steamy fumes / HCl, or Add carboxylic acid AND (conc) sulfuric acid to produce fruity / sweet smell or if alkene in (v) Br ₂ decolourised / brown to colourless				1
					[9]

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(b) (i)		FA 9	FA 10	4	
	NaOH	No marking points for observations here			
	Al	Effervescence / fizz / bubbles	Effervescence / fizz / bubbles		
		Fizz / gas / ammonia turns litmus blue	Fizz / gas / ammonia turns litmus blue		
heat	Any 2 from: <ul style="list-style-type: none"> • Melts / dissolves / becomes liquid • Condensation / steam / water vapour • Brown gas / gas turns litmus red • Gas relights glowing splint • Solid turns yellow 	Any 1 from: <ul style="list-style-type: none"> • Bubbles • Gas relights glowing splint • Melts / dissolves and to yellow (liquid / solution) 			
(ii)	Nitrate / nitrite			1	
(iii)	Add named acid and (observe) brown gas for nitrite or Add (acidified) potassium manganate(VII) / KMnO_4 and purple to colourless / decolourised for nitrite			1	
(iv)	No reaction for either so anion in each is nitrate / NO_3^-			1	[7]
Question 3					[16]