UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2009 question paper for the guidance of teachers

9701 CHEMISTRY

9701/33 Paper 33 (Advanced Practical Skills), maximum raw mark 40

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UNIVERSITY of CAMBRIDGE
International Examinations

Question	Sections	Indicative material	Mark	
1 (a)	PDO Layout MMO Collection	Three weighings recorded unambiguously (words needed) Mass used between 1.80 g and 2.00 g (for all experiments) Mass decreases after heating in a **single** experiment attempted (no repeat experiment allowed) (ignore heating to constant mass**)**	1 1 1	[3]
(b)	ACE Interpretation	Correct subtraction from experimental results in **(a)** for mass of water lost **and** for mass of residue (correct for any experiment attempted or for an average)	1	[1]
(c)	PDO Display ACE Interpretation	Shows working using values from (b) (can be ecf): $^{\text{mass of salt}}/_{151.9}$ and $^{\text{mass of water}}/_{18}$ or candidate's value of M_r Correct calculation of each value and must have between 2 and 4 sf and correct rounding (NO ecf from incorrect M_r but ecf allowed from masses used in first part)	1 1	[2]
(d)	ACE Interpretation PDO Display	Values from (c) shown in correct calculation or ratio **or** value of correct calculation showing dp and correct rounding for sf shown Value of ***x*** for fully correct answer given as an integer allow 0.5 to go up or down (ecf allowed) (If correct integer shown but no expression or calculation is shown award second mark only)	1 1	[2]

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Question	Sections	Indicative material	Mark	
(e)	PDO Layout	**(i)** Tabulates minimum of two pairs of burette readings or at least two titres (lines not needed)	1	
	PDO Recording	**(ii)** Records initial and final burette readings and volume of **FA3** run from the burette (Do not award if readings inverted or final is 50. 50.0, 50.00 more than once, or initial value is 50.00)	1	
		(iii) Appropriate headings and units for data given. *(Only acceptable headings are: initial/final, first/second (burette) reading; reading at start/finish;* ***volume*** *added/used or wwte; titre. Only acceptable presentation of units is: solidus / cm^3; brackets (cm^3)* ***or*** *"volume in cubic centimetres" or "volume in cm^3")* *If units not included with heading, every entry in table must have a correct unit.*	1	
		(iv) All burette readings other than that labelled rough recorded consistently (to nearest 0.05 cm^3)	1	
	MMO Decisions	**(v)** Two uncorrected titres within 0.1 cm^3 (can include rough)	1	
	MMO Quality	**(vi)**, **(vii)**, **(viii)** and **(ix)** Check and correct titre subtractions where necessary. (If there are any showing greater precision than to 0.05, correct to the nearest 0.05 cm^3) Examiner selects the best mean titre (treat as accurate unless labelled rough or to fewer dp but if rough is ticked or selected by candidate it can be considered) and compared to Supervisor: *Apply a hierarchy:* *2 identical, titres within 0.05 cm^3, titres within 0.10 cm^3 etc.* Award **(vi)**, **(vii)**, **(viii) and (ix)** for: a titre within 0.20 cm^3 Award **(vi)**, **(vii)**, **(viii)** **only** for: a titre of 0.20+ cm^3 to 0.30 cm^3 Award **(vi)** and **(vii)**, **only** for: a titre of 0.30+ cm^3 to 0.50 cm^3 Award **(vi)** **only** for: a titre of 0.50+ cm^3 to 0.80 cm^3 Apply spread penalty as follows: titres selected by examiner differ > 0.2 but ≤ 0.5 cm^3 = –1; titres > 0.5 cm^3 = –2 from the marks awarded in **(vi)** to **(ix)** (no negative marks). Apply a spread penalty of –2 if only one titration is performed or a single value is selected by examiner (e.g. rough + one other)	4	
	MMO Decisions	**(x)** Selects (and ticks) at least two titres for calculation of mean titre (some indication must be made of which ones used). The spread of any titres used must not exceed 0.20 cm^3	1	

(continued)

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Question	Sections	Indicative material	Mark	
(e) continued	PDO Display	**(xi)** Correct mean displayed to same number of decimal places as burette readings (If any burette reading is to 2 dp then mean to 2 dp; if two titres 0.05 apart then 0.025 or 0.075 is acceptable; similarly if titres recorded to1 dp then 0.05; to no dp then to 0.5. If three titres used giving mean of 0.033... or 0.066... then allow mean to nearest 0.05)	1	[11]
(f)	ACE Interpretation	Maximum error for single reading of burette given as 0.05 cm^3 (even if readings recorded to 1 dp) Correct calculation to 2 sf (minimum) showing correct rounding of maximum % error $\underline{2}$ x candidate's error / titre x 100 or allow $^{0.10}/_{titre}$ x100 if 0.1 in first box.	1 1	[2]
(g)	ACE Conclusions	**Mark (g) and (h) as a single unit** (Mass loss is too high) Candidate suggests spitting or decomposition or overheating/heating too long (The latter will not gain any other mark unless a consequence of overheating is given.)	1	[1]
(h)	ACE Improvement	Use of lid or gentle heating (at first) – to reduce spitting/loss of solid **or** reduced temperature or heat for a shorter time – to prevent decomposition Explains that mass loss is too high or wtte (e.g. some solid spits out) and how modification will reduce this or a realisation that something other than water is lost.	1 1	[2]
Qn 1	**Total**			**[24]**

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Question	Sections	Indicative material	Mark	
FA 5 is $NaNO_2$(aq); FA 6 is NaC*l* (aq); FA 7 is KI; FA 8 is distilled water				
2 (a)	MMO Decisions	Chooses a named (dilute) strong acid to identify the nitrite (name could be in (b)). **and** Chooses silver nitrate or lead nitrate to identify the chloride and iodide ($Ag^+_{(aq)}$ or aqueous solution of silver ions accepted, ditto lead ions)		[1]
(b)	MMO Collection	**(i)** Records a brown gas from **FA 5** and acid and no reaction with second reagent. **(ii)** Records a colourless or blue solution on adding acid to **FA5** **(iii)** Records a white precipitate when Ag^+ or Pb^{2+} is added to **FA 6** and no reaction with acid **(iv)** Records a yellow precipitate when Ag^+ or Pb^{2+} is added to **FA 7** and no reaction with acid. If acid alone used and all four observations are correct **(i)** and **(ii)** and identity mark **(v)** can be awarded. If $AgNO_3$ or $Pb(NO_3)_2$ only used and all four observations are correct then can award **(iii)** and **(iv)** and identity mark **(vi)**. If a white ppt is recorded with **FA5 and all other observations are correct** award **(iii)** and **(iv)** but then deduct one observation mark for the **FA5** result. (Annotate the paper near the boxes.) Mark **(vi)** would be available to a candidate concluding both **FA5** and **FA6** are Cl^- and **FA7** is I^-. If a spurious reagent is chosen in **(a)** ignore and mark other (if correct) as single reagent. If three reagents are used, mark the observations for acid and the first of Ag^+ or Pb^{2+} mentioned in **(a)**. Deduct one mark (from **(i)** – **(iv)**) if erroneous observation with **FA8** or test not done. A dash is similarly penalised (once, at the first opportunity) **(v)** and **(vi)** are consequent on observations	1 1 1 1	
	ACE Conclusions	**(v)** Identifies nitrite in **FA 5** Allow from effervescence or bubbling from FA5 + acid only. **(vi)** Identifies chloride in **FA 6** (only, unless single reagent as above) and iodide in **FA 7**	1 1	
	ACE Interpretation	**(vii)** Gives appropriate evidence for identification of all three ions (consequential on observations) (Brown gas with acid + **FA5** needed here.)	1	[7]
(c)	MMO Decisions	Add (aqueous) ammonia to the precipitate formed with silver nitrate **or** Add (aqueous) lead nitrate or silver nitrate (to a fresh sample of) the solution Do not penalise lack of (aq) with an ion if already penalised in **(a)**	1	[1]
Qn 2	**Total**			**[9]**

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Question	Sections	Indicative material	Mark	
FA 9 is $Pb(NO_3)_2$, FA 10 is K_2CrO_4				
3 (a)	MMO Collection	White ppt formed in tests **(i)** and **(ii)** and yellow ppt in test **(v)** (no variation on white; ppts not soluble in excess acid) Solution changes from yellow to orange (both colours and 'solution' needed) in **(iii)** (Solution) changes to green or blue (blue/green, cyan, turquoise but no orange or orange–brown as final colour) in **(iv)** Ignore state	1 1 1	[3]
(b)	ACE Conclusions	**FA 9** contains the cation Pb^{2+} or lead II (all three ppts must be in (a) but ignore any $PbCl_2$ ppt redissolving; no Ba^{2+} unless no ppt with HC*l*) (White) ppt with both HC*l* and H_2SO_4 given as evidence or yellow ppt with **FA10 named as chromate** or CrO_4^{2-}	1 1	[2]
(c)	ACE Conclusions	States that ethanol is being oxidised or is reducing agent or reduces **FA10** Ethanol oxidised to ethanal or alcohol oxidised to aldehyde **or** chromate VI reduced to chromium III or dichromate reduced to chromium III	1 1	[2]
Qn 3	**Total**			**[7]**

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