UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

Specimen for 2007

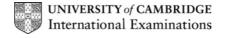
GCE A/AS LEVEL

MARK SCHEME

MAXIMUM MARK: 40

SYLLABUS/COMPONENT: 9701/31

ADVANCED PRACTICAL SKILLS



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Skill	Total marks	Breakdown of marks/exped	ctations	Question 1	Question 2
Manipulation, measurement	16 marks	Successful collection of data and observations	8 marks	2	6
and observation		Decisions relating to measurements or observations	8 marks	5	3
Presentation of data and observations	12 marks	Recording data and observations	5 marks	3	1
Observations		Display of calculation and reasoning	3 marks	3	0
		Data layout	4 marks	4	0
Analysis, conclusions and	12 marks	Interpretation of data or observations and identifying sources of error	6 marks	2	4
evaluation		Drawing conclusions	5 marks	3	1
		Suggesting improvements	3 marks	1	1

MMO = Manipulation, measurement and observation

Collection = Successful collection of data and observations

Decisions = Decisions relating to measurements or observations

PDO = Presentation of data and observations

Recording = Recording data and observations

Display = Display of calculation and reasoning

Layout = Data layout

ACE = Analysis, conclusions and evaluation

Interpretation = Interpretation of data or observations and identifying sources of error

Conclusions = Drawing conclusions

Improvements = Suggesting Improvements

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Que	stion	Sections	Learning outcomes	Indicative material	mark
1	(a)	PDO Display	 show their working in calculations, and the key steps in their reasoning 	correct working for volume of H ₂ SO ₄	1
	(b)	MMO decisions	decide how many tests or observations to perform	appropriate volume of acid added each time (between 2 and 4 cm³) volumes spanning a sufficient range each side of calculated end point (between 20 and 30 cm³ below end point and 10 and 20 cm³ above end point)	1
	(c)	PDO Recording	 draw up table in advance of taking readings so that they do not have to copy results 	no evidence on script of table having been produced or added to after measurements made;	1
			 use column headings that include both the quantity and the unit and that conform to 	volume, temperature and ΔT columns correctly labelled	1
			accepted scientific conventionsrecord raw readings of a quantity to the same degree of precision	volumes and temperatures recorded to consistent significant figures	1
		MMO collection	 making measurements using burettes and 	all volumes recorded to 0.05 cm ³ ;	1
		25556	thermometers	all temperatures recorded to 0.5 °C;	1
		MMO decisions	 make and record sufficient, accurate measurements 	volume at which max temp rise recorded within 5 cm ³ of Supervisor;	1
				ΔT for highest temp within 1 °C of that obtained by Supervisor (1 of these two marks if in range +1 °C to 3 °C)	2

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(d)	PDO Layout	 plot appropriate variables on clearly labelled x- and y- axes 	ΔT plotted on y-axis and volume of acid on x-axis, correctly labelled including units;	1
		choose suitable scales for graph axesplot all points to an	suitable scales selected;	1
		appropriate accuracy.	points plotted as fine cross or encircled dot within ½ small square in either direction;	1
		follow the ASE recommendations for putting lines on graphs	two smooth intersecting curves drawn	1
(e)	ACE Interpretation	find an unknown value by using intercept on a graph	reading the volume of H ₂ SO ₄ at the end-point from the intercept of the graph	1
(f)	PDO Display	show working in calculations, and the key steps in reasoning	shows working and explains the steps in the calculation;	1
		 use the correct number of significant figures for calculated quantities 	calculates concentration to same sf as titre/volume information recorded	1
(g)	ACE Conclusions	draw conclusions from an experiment, giving an outline description of the main features of the data, considering whether experimental data supports a given hypothesis.	first part of hypothesis not supported as the graph is not a straight line. (hypothesis supported is acceptable if the graph is a straight line)	1
			shape of graph described	1
			second part of hypothesis is supported as temperature falls after the end-point	1
(h)	ACE Interpretation	identify the most significant sources of error in an experiment	comments on the closer spacing of temperatures at higher values or curve with decreasing gradient;	1
			explains that heat loss is greater/more rapid at higher temperatures	1
(i)	ACE Interpretation	 estimate, quantitatively, the uncertainty in quantitative measurements express such uncertainty as an actual or percentage error 	calculates 0.05 or 0.10 as a % of the end-point volume	1
(j)	ACE Improvements	suggest modifications that will improve the accuracy of the experiment	calculates (total volume x ΔT x 4.3)	1

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2	(a)	MMO Decisions	selecting a suitable reagent	use of Pb(NO ₃) ₂ or AgNO ₃ /NH ₃ (aq) as reagent;	1
		MMO Collection	 use apparatus to collect an appropriate quantity of data or observations, including subtle differences in colour, solubility or quantity of materials 	records appropriate observation for selected reagent	1
	(b)	MMO Decisions	selecting a suitable reagent	use of Pb(NO ₃) ₂ or AgNO ₃ /NH ₃ (aq) as reagent;	1
		MMO Collection	 use apparatus to collect an appropriate quantity of data or observations, including subtle differences in colour, solubility or quantity of materials 	records appropriate observation for selected reagent	1
		ACE conclusions	 draw conclusions from interpretations of observations 	draws a conclusion appropriate to the observations in (a) and (b)	1
	(c)-(f)	MMO collection	follow instructions given in the form of written instructions	all tests attempted and some observation recorded	1
			use apparatus to collect an appropriate quantity of data or observations, including subtle	at least three initial precipitates correctly recorded	1
			differences in colour, solubility or quantity of materials	colours of precipitates correctly described	1
				solubility of precipitates in excess NaOH/NH ₃ correctly described	1
		MMO decisions	make appropriate qualitative observations	appropriate test for ammonia gas recorded	1
		PDO recording	record observations to the same level of detail	consistent standard in recording observations i.e. all precipitates and their solubilities in excess recorded	1

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(g)	ACE Interpretation	describes and summarises the key points of a set of observations.	explains how the observations identify and confirm the presence of Ba ²⁺ . explains how the reaction with sodium hydroxide and ammonia identifies A l ³⁺ or Pb ²⁺ as the unknown cation explains which tests eliminate Pb ²⁺	1
(h)	ACE Improvements	 suggest ways in which to extend the investigation 	suggests dilute acid to liberate NO	1