



General Certificate of Education

Chemistry 2420

**CHM6X Externally Marked Practical
Assignment**

Mark Scheme

2010 examination - June series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Task 1 Assessment

Question	Part	Marking Guidelines	Mark	Additional guidance
		Results recorded clearly and in full in a sensible table	(R) 1	If you can read it, it is clear Full means completes all of the boxes
				Check the teacher observations against the answers below Allow either the published answer or the teacher alternative, as long as this is reasonable If answers contradict e.g. "No visible change with green precipitate" then scoring point is not awarded Look for the basic colour; ignore additional shades if the answer is unambiguous Mark Test 1 out of 2 if there is no mention of a precipitate by teacher and candidates
		Cr ₂ (SO ₄) ₃ and NaOH solution green precipitate	(A) 1	Accept 'suspension', 'sediment' or 'solid (deposit)' as well as 'precipitate' Do not accept 'cloudy', 'misty' or 'emulsion'
		green solution	(A) 1	
		yellow solution	(A) 1	Does not have to mention solution again if already given for previous observation
		Universal indicator solution no visible change	(A) 1	Accept 'no change', 'no reaction', 'stays the same' or 'green solution' A very common teacher observation is 'orange', allow this. Do not allow 'red solution'
		MnO ₂ colourless gas evolved	(A) 1	Accept 'effervescence', 'fizz' and 'bubbles of gas' Ignore 'misty fumes'
		Total	6	

Task 2 Assessment

Question	Part	Mark scheme	Mark	Additional guidance
		Results recorded clearly and in full in a sensible table	(R) 1	If you can read it, it is clear 'Full' means the table must have Initial reading, Final reading and Titre values for at least two sets of results Table does not have to have gridlines Allow clear answer outside of a table box Lose this mark if there is an arithmetic error in calculating a titre Units are not needed in a results table, but if given they must be correct Labels such as <i>Initial reading</i> , <i>Final reading</i> etc are not needed in this very familiar table
1	a	All titre volumes to 0.05 cm ³	(P) 1	Allow zero entries as 0 or 0.0
1	b	Concordant if two results are within 0.10 cm ³ of each other	(C) 1	Award the mark for concordancy if the table contains at least two concordant results, even if candidate has not recognised these as concordant results.
2		The accuracy of the candidate's average titre, measured against a teacher value for the titration. average titre within 1% of teacher value 5 marks average titre within 1.5% of teacher value 4 marks average titre within 2% of teacher value 3 marks average titre within 2.5% of teacher value 2 marks average titre within 3.0% of teacher value 1 mark	(A) 5	If a student has two concordant titres then both concordancy and accuracy marks can be awarded If a student does not have two concordant titres but does have two titres within 0.20 cm ³ of each other, then the concordancy mark cannot be awarded but the accuracy marks can Titres which differ from each other by more than 0.20 cm ³ cannot receive concordancy or accuracy marks Check that the student has calculated the average titre correctly. If not, calculate the correct average and base the student's accuracy mark on the correct average. The student does not have to use all of the concordant titres in obtaining an average If a student has one set of concordant results, and has correctly identified these results, base the accuracy mark

				<p>on the student's average titre</p> <p>A student may have one set of concordant results, but uses a non-concordant titre in calculating the average. Average all of the student's concordant titres, and use this average to determine the mark for accuracy</p> <p>A student may have two sets of concordant results, which do not overlap. The teacher should choose the set of concordant titres that gives the higher accuracy mark, even if the student chooses the other set. Allow a correct calculation of an average titre for either set of concordant results</p>
		Total	8	

Section A Ignore absence of units unless units are required in the Marking Guidelines. Incorrect units lose the mark

Question	Part	Mark Scheme	Mark	Additional Guidance
1	a	Yellow solution with alkaline Cr(III)	1	Allow consequential answer from candidate's results Allow (an identification of) oxygen produced in Test 3
1	b	H ₂ O ₂ not an acid/ not an alkali/ is neutral	1	Allow consequential answer from candidate's results
2		Ppt is iron(III) hydroxide Colour is red-brown/ orange	1 1	Allow name or formula Allow brown if no name or formula given Do not allow a consequential mark here from candidate's name or formula
3		Correct average titre using all of the candidate's concordant results	1	Ignore precision of answer but watch for AE Allow answer corrected to 0.05 tolerance (if answer 25.13, allow 25.10, 25.13 or 25.15)
4		$5\text{H}_2\text{O}_2 + 2\text{MnO}_4^- + 6\text{H}^+ \rightarrow 5\text{O}_2 + 2\text{Mn}^{2+} + 8\text{H}_2\text{O}$	1	Allow multiples of this equation. Do not allow other answers Do not allow redundancy of H ⁺ ions
5		Moles MnO ₄ ⁻ = (answer from Q3) x 0.02 x 10 ⁻³ Moles H ₂ O ₂ = (answer from Q3) x 0.02 x 10 ⁻³ x 2.5	1 1	Do not penalise precision Do not penalise precision
6		Answer from Q5 x 40 Answer given to 3 sig figs	1 1	Allow working for 5 and 6 anywhere in either answer space so long as not contradicted
7	a	34.0	1	Penalise precision once – do not penalise here if second mark lost in Q6
7	b	1.76 mol dm ⁻³	1	
7	c	answer to Q7b divided by 0.05 Shows working	1 1	35(.3) on correct figures Correct answer only scores this mark Lose this mark if any units are given for the factor
		Total	14	

Section B Ignore absence of units unless units are required in the Marking Guidelines. Incorrect units lose the mark

Question	Part	Marking Guidelines	Mark	Additional Guidance
8		Log (1/time) on the y-axis + log (vol) on x-axis	1	If axes unlabelled use data to decide that log (1/time) is on the y-axis
		Sensible scales	1	Lose this mark if the plotted points do not cover at least half of the paper Lose this mark if the graph plot goes off the squared paper Lose this mark if plots a non-linear/broken scale Lose this mark if uses an ascending y axis of negative numbers
		Plots points correctly \pm one square	1	
		Line through the points is smooth	1	Lose this mark if the candidate's line is doubled
		Line through the points is best fit – ignores last point	1	Must recognise that point at 25 cm ³ is an anomaly If wrong graph, mark consequentially on anomaly if correctly plotted. A kinked graph loses smooth and best fit marks
9		Uses appropriate x and y readings	1	Allow taken from table or taken or drawn on graph Must show triangle on graph or such as $\frac{1.65-1.2}{1.4-0.9}$
		Correctly calculates gradient 0.95 \pm 0.02	1	Ignore positive or negative sign Correct answer only with no working scores this mark
		Answer given to 2 decimal places	1	
10		First order or order is 1	1	Allow consequential answer from candidate's results

11		Thermostat the mixture/ constant temperature/ use a water bath or Colorimeter/ uv-visible spectrometer/ light sensor to monitor colour change	1	
		Reaction/ rate affected by temperature change or Eliminates human error in timing/ more accurate time of colour change	1	
12	a	Fractional distillation (under reduced pressure)	1	
12	b	BaSO ₄ insoluble/ remove by filtration	1	Do not allow answers which refer to reaction rate
12	c	Both contain OH group	1	Allow OH stretch in ir spectrum of each compound Do not allow 'same bonds'
13	a	Decomposition photocatalysed/ accelerated by <u>light</u>	1	Allow 'uv /sunlight' Do not allow 'heat' as reason.
13	b	<u>Decomposition products</u> are harmless	1	Do not allow answers which only refer to products without comment on safety
		Total	16	

Section C Ignore absence of units unless units are required in the Marking Guidelines. Incorrect units lose the mark

Question	Part	Mark Scheme	Mark	Additional Guidance
14		Figure 2	1	Do not accept 'poor yield' without qualification Can gain this mark if logic correct but has chosen wrong Figure
		Further oxidation will occur/ ethanoic acid formed	1	
15		(Calibrate) meter with solution(s) of known pH/buffer(s)	1	Do not accept 'repeat reading'
		Adjust meter/plot calibration curve	1	
16		Sample in capillary/ melting point tube	1	Accept alternative as long as small container used
		Heat in melting point apparatus/ heat <u>gently/slowly</u> near melting point	1	
Total			6	