

General Certificate of Education

Chemistry 5421

CHM3/P Practical

Mark Scheme

2005 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.

Exercise 1	Mark scheme	Skill assessed Implementing (2)
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1. Points assessed by supervisor during the practical examination

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|-----|--------------------------------|--|---|
| (a) | (i) use of the pipette | 1 empties under gravity
2 transfers from pipette without spillage
3 touches surface with pipette | 10 scoring points |
| | (ii) use of the burette | 4 uses acid in burette, and alkali in the pipette
5 removes the funnel before titrating
6 dropwise addition near the endpoint any
7 swirls mixture
8 reads burette correctly | any 8 including
works safely
= 2 marks
any 5 = 1 mark |
| | (iii) general | 9 does not require additional sample
10 works safely | |

2. Points assessed from candidate's written report.

- | | | | |
|-----|--|---|---|
| (b) | the recording of results | results recorded clearly and in full in the table

Notes * <i>if you can read it, it is clear</i>
* <i>full means completes at least two columns correctly</i>
* <i>allow clear answer outside of the box</i>
* <i>check candidate's subtractions- one error means candidate loses mark</i> | 1 mark |
| (c) | the awareness of precision | at least 2 titrations which are counted
indicates results which are counted
titre volumes to 0.05 cm ³ | 3 scoring points
all 3 = 1 mark |
| | Notes | * <i>ignore zero entries</i>
* <i>allow one other error</i> | |
| (d) | the concordancy | concordant if two results are within 0.10 cm ³ of each other

Notes * <i>award the mark for concordancy if the table contains at least two concordant results</i> | 1 mark |
| (e) | The accuracy of the mean value, measured against a teacher value for the titration. | mean titre is within 1% of target value 3 marks
mean titre is within 1.5 % of target value 2 marks
mean titre is within 2% of target value 1 mark | 3 marks |
| | Notes | * <i>ensure average titre is calculated correctly</i>
* <i>if value entered by the candidate is wrong, underline the wrong value and write the correct value by the side</i>
* <i>use the corrected value to assess accuracy</i>
* <i>if staff value is wrong or missing use a group average; complete a discrepancy form</i>
* <i>when calculating a group average ignore wild data</i> | |

Total 8

Exercise 2	Mark scheme	Skills assessed	Analysing (3) Evaluating (4)
Skill 3	Analysing		
1.	Correct equation Notes * Allow CaCO_3 etc * Do not allow H_2CO_3	$2\text{HCl} + \text{MCO}_3 = \text{MCl}_2 + \text{CO}_2 + \text{H}_2\text{O}$	1 mark
2.	Completes table and calculates a mean titre Notes * If no working allow this mark but loses nomenclature mark * If candidate averages all of the titres loses this mark; do not penalise again in nomenclature	19.10	1 mark
3.	Calculates the moles of MCO_3 Notes * Allow consequential answer from part 2 * Averaging all titres gives 19.23 and 9.62×10^{-3}	9.55×10^{-3}	1 mark
4.	Calculates the M_r of MCO_3 Notes * Allow consequential answer from part 3 * 9.62×10^{-3} gives 104.0	104.7	1 mark
			* Ignore g unit
5.	Uses data to confirm the Group II metal is Ca Notes * Allow consequential answer from part 4 * Must show working clearly to score this mark, but don't penalise again in awarding the nomenclature mark * Allow use of data from Evaluation 2 as long as clearly explained		1 mark
6.	Errors	calculates the % error for the balance $\pm 1.0\%$ calculates the % error for the burette $\pm 0.8\%$ calculates the overall apparatus error $\pm 1.8\%$	3 scoring points all 3 = 1 mark
	Notes * Ignore precision of answers * Consequential marking for overall error * Penalise doubled errors once * Lose mark if answers wrong because ($\times 100$) missing from calculations; don't penalise again in awarding the nomenclature mark * Which error being calculated is not stated; allow if the calculations are in the same order as in the question (balance, burette). And do not penalise in nomenclature		
(7)	Precision	quotes average titre as 19.10 cm^3 or 2dp quotes M_r to 1 decimal place	2 scoring points both = 1 mark
	Notes * If no answer to part 4 can't score this mark		
(8)	Nomenclature	clear calculation of average titre calculations clear & logical, with sensible layout units where used are correct	all 3 = 1 mark
	Notes * Incorrect units mean the nomenclature mark is lost * Two blank sections mean the nomenclature mark is lost * Don't penalise missing units		

Exercise 3 Mark scheme Skill assessed **Planning (1)**

- (a) the **scale** of working used
 sensible volume of HA solution (20 cm³ to 100 cm³) **maximum 4 points (s)**
 sensible volume of NaOH solution (same or slight excess)
 appreciates need for significant ΔT (at least 5°)
 appropriate concentration of HA solution (at least M)

Notes * To score last two points need a definite **correct** link between conc and ΔT

- (b) the **method** used

- (i) **apparatus**
 polystyrene cup or other suitable *don't allow bomb calorimeter* **maximum 4 points (a)**
 support e.g. beaker or suitable clamp
 measuring cylinders or pipettes *allow without precision specified*
accurate thermometer (0.1°C or 0.5°C) *don't allow digital without stated accuracy*
 lid or lagging for the calorimeter

Notes *Can score these marks from a diagram, even if not labelled, but not from a list
 *Ignore additional apparatus unless renders experiment void, when CE
 means no points scored in this section

- (ii) the **procedure** used
 measures initial temperature acid solution **maximum 6 points (m)**
 measures initial temperature alkali solution
 transfers acid solution to cup
 adds alkali
 records temperature at suitable intervals **or** records highest temperature reached
 thermometer bulb immersed in liquid (*can score from diagram*)
 stirs mixture
 repeats experiment

Notes * Allow adding acid to alkali
 * Can score initial temperature of reagent in cup from graph
 * If method unworkable mark up to point where method fails
 * If method seriously unsafe penalise **1 mark**

- (c) the **use of results**
 plots a labelled graph of temperature against time **maximum 6 points (r)**
 graph has correct profile **and** extrapolation
 temperature rise read correctly (can score from diagram) **or** determines maximum ΔT
 correct $m\Delta T$ calculation
 scales up to molar quantities
 by appropriate factor (x 40 for 25 cm³ of M)

- (d) the **appreciation of likely hazards and safety precautions** **maximum 2 points (h)**
 reagents harmful / toxic / irritant etc wash spillages with cold water/ wear gloves
 eye protection
 pipette filler if using a pipette

Notes

** Need hazard and precaution for first point*

22 scoring points	21 - 22	scores	8 marks	9 - 11	scores	4 marks
	18 - 20	scores	7 marks	6 - 8	scores	3 marks
	15 - 17	scores	6 marks	3 - 5	scores	2 marks
	12 - 14	scores	5 marks	1 - 2	scores	1 mark