



ASSESSMENT and
QUALIFICATIONS
ALLIANCE

Mark scheme

June 2002

GCE

Chemistry

Unit CHM3/P

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

- | | | | |
|--------------------------------|---|---|------------------|
| (a) (i) graduated flask | 1 | final level is on the graduation mark | |
| (ii) pipette | 2 | empties under gravity | |
| | 3 | transfers from pipette without spillage | 9 scoring points |
| | 4 | touches surface with pipette | |
| (iii) burette | 5 | uses acid in burette, and alkali in the pipette | any 7 = 2 marks |
| | 6 | removes the funnel before titrating | any 4 = 1 mark |
| | 7 | dropwise addition near the endpoint | |
| | 8 | swirls mixture | |
| (iv) general | 9 | does not require additional sample | |

2. Points assessed from candidate's written report.

- | | | |
|--|---|---|
| (b) the recording of results | results recorded clearly and in full in the table | 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 |
| (d) the concordancy
mark | concordant if two results are within 0.1 cm ³ of each other | 1 |
| (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 | 3 marks |
| mean titre is within 1.5 % of target value | 2 marks | |
| mean titre is within 2% of target value | 1 mark | |

Total 8 marks

Exercise 2 Skill 3 Analysing

- | | | | |
|-----|---|---|----------------------|
| 1. | correct equation | $\text{HCl} + \text{Na}_2\text{CO}_3 \rightarrow \square\square \text{NaHCO}_3 + \text{NaCl}$ | 1 mark |
| 2. | calculates average titre correctly | 19.10 cm ³ | 1 mark |
| 3. | calculates the moles of Na ₂ CO ₃ | 1.91 x 10 ⁻³ | 1 mark |
| 4. | calculates the <i>M_r</i> of Na ₂ CO ₃ | 131 | 1 mark |
| 5. | calculates the moles of H ₂ O | 1 or 1.38 | 1 mark |
| 6. | the appreciation of errors | | |
| | calculates the percentage error in use of balance (± 4.0%) | | 3 scoring points |
| | calculates the percentage error in use of burette (0.15 cm ³ in 19.1 is 0.79%) | | any 2 = 1 mark |
| | calculates the overall apparatus error (4.79% on above values) | | |
| (a) | the appreciation of precision | | |
| | quotes average titre as 19.10 cm ³ ie 2 decimal places | | 3 scoring points |
| | quotes <i>M_r</i> to 3 significant figures or 1 decimal place only | | any 2 = 1 mark |
| | quotes the moles of H ₂ O as whole number | | |
| (b) | the correct use of nomenclature and terminology | | |
| | explains the calculations clearly and logically, with a sensible layout | | 2 scoring points |
| | uses terminology accurately e.g. moles not confused with molarity or <i>M_r</i> | | both = 1 mark |

Total 8 marks

Exercise 2 Skill 4 Evaluating

- | | | | |
|----|---|--------------------------------------|----------------------------|
| 1. | first titration poor / probably a rough titration | | 3 scoring points |
| | three good / concordant results or three results within 0.1 cm ³ | | all 3 = 2 marks |
| | so titration technique good or results reproducible or results consistent | | any 2 = 1 mark |
| 2. | calculation of difference | | 2 scoring points |
| | 131 against 124 is a 5.6% error | | both = 1 mark |
| 3. | appreciates discrepancy > maximum apparatus error | | 1 mark |
| 4. | dry weighing bottle | mass used known more accurately | |
| | or weigh by difference | | |
| | or include washings | | any 2 improvements + |
| | ----- | | 2 reasons = 2 marks |
| | use more accurate balance | mass used known more accurately | |
| | or use a larger mass | or quoted number of decimal places | any 1 improvement + |
| | ----- | | 1 reason = 1 mark |
| | prepare a standard solution | obviates errors in multiple weighing | |
| | or get consistent samples | | any 2 improvements |
| | ----- | | = 1 mark |
| | keep in sealed container | prevent absorption or loss of water | |
| | or keep in dry conditions | | |

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

- (a) the **scale** of working used (s) **maximum 5 points**
 sensible volume of CuSO_4 soln. in cup (20 cm^3 to 250 cm^3)
 calculates moles CuSO_4 (5×10^{-3} for 25 cm^3)
 deduces moles of zinc needed (as above)
 calculates mass of zinc (0.325g for 25 cm^3)
 uses excess zinc
- (b) the **method** used
- (i) **apparatus** (a) **maximum 4 points**
 polystyrene cup or other suitable
 support e.g. beaker or suitable clamp
 measuring cylinders or pipettes
accurate thermometer (0.1°C or 0.5°C or digital)
 lid or lagging for the calorimeter
- (ii) the **procedure** used (m) **maximum 6 points**
 measures initial temperature CuSO_4 soln.
 transfers CuSO_4 soln. to cup
 adds weighed quantity of zinc
 thermometer bulb immersed in liquid (can score from diagram)
 stirs mixture
 records temperature at suitable intervals **or** records highest temperature reached
 repeats experiment
- (c) the **use of results** (r) **maximum 6 points**
 plots a graph of temperature against time
 labels axes
 graph has correct profile
 extrapolates graph to allow for heat loss
 temperature rise read correctly (can score from diagram) **or** determines maximum ΔT
 $m c \Delta T$ calculation
 scales up to molar quantities
 by appropriate factor ($\times 200$ for 25 cm^3 of 0.2M)
- (d) the **appreciation** of **likely hazards** and **safety precautions** (h) **maximum 2 points**
 reagents and products are harmful / toxic / irritant etc
 eye protection
 wash spillages with cold water/ wear gloves
 pipette filler

Grading

23 scoring points

21 - 23	scores 8 marks
18 - 20	scores 7 marks
15 - 17	scores 6 marks
12 - 14	scores 5 marks
9 - 11	scores 4 marks
6 - 8	scores 3 marks
3 - 5	scores 2 marks
1 - 2	scores 1 mark

Total 8 marks