AQA

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark scheme June 2002

GCE

Chemistry

Unit CHM3/P

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Registered address: Addleshaw Booth & Co., Sovereign House, PO Box 8, Sovereign Street, Leeds LS1 1HQ
Kathleen Tattersall: *Director General*

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 $HCl + Na_2CO_3 \rightarrow \square\square NaHCO_3 + NaCl$ **1 mark**

2. calculates average titre correctly **19.10 cm^3** **1 mark**

3. calculates the moles of Na_2CO_3 **1.91×10^{-3}** **1 mark**

4. calculates the M_r of Na_2CO_3 **131** **1 mark**

5 calculates the moles of H_2O **1 or 1.38** **1 mark**

6. the appreciation of **errors**
   calculates the percentage error in use of balance (± 4.0%)
   calculates the percentage error in use of burette (0.15 cm^3 in 19.1 is 0.79%)
   calculates the overall apparatus error (4.79% on above values)
   3 scoring points
   any **2** = **1 mark**

(a) the appreciation of **precision**
   quotes average titre as 19.10 cm^3 ie 2 decimal places
   quotes M_r to 3 significant figures **or** 1 decimal place only
   quotes the moles of H_2O as whole number
   3 scoring points
   any **2** = **1 mark**

(b) the correct use of **nomenclature** and **terminology**
   explains the calculations clearly and logically, with a sensible layout
   uses terminology accurately e.g. moles not confused with molarity or M_r
   2 scoring points
   both = **1 mark**

Total 8 marks

Exercise 2 Skill 4 Evaluating

1. first titration poor / probably a rough titration
   three good / concordant results **or** three results within 0.1 cm^3
   so titration technique good **or** results reproducible **or** results consistent
   3 scoring points
   all 3 = **2 marks**
   any **2** = **1 mark**

2. calculation of difference
   131 against 124 is a 5.6% error
   2 scoring points
   both = **1 mark**

3. appreciates discrepancy > maximum apparatus error
   1mark

4. dry weighing bottle — mass used known more accurately
   or weigh by difference
   or include washings
   ---
   use more accurate balance — mass used known more accurately
   or use a larger mass — or quoted number of decimal places
   ---
   prepare a standard solution — obviates errors in multiple weighing
   or get consistent samples
   ---
   keep in sealed container — prevent absorption or loss of water
   or keep in dry conditions

   any 2 improvements + 2 reasons = **2 marks**
   any 1 improvement + 1 reason = 1 ma
   any 2 improvements = 1 mark

Total 6 marks

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 x 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
$mc\Delta T$ calculation
scales up to molar quantities
by appropriate factor (x 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