



ASSESSMENT and  
QUALIFICATIONS  
ALLIANCE

# Mark scheme

# June 2003

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## GCE

## Chemistry

## Unit CHM6/P

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**Exercise 1**

Mark scheme

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

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

2. Points assessed from candidate's written report.

|  |  |  |
|--|--|--|
| (b) the <b>recording</b> of results  | results recorded clearly and in full in the table  | <b>1 mark</b>                                    |
| <b>Notes</b>   | <i>* if you can read it, it is clear</i><br><i>* full means completes at least two columns correctly</i>   |  |
| (c) the awareness of <b>precision</b>  | at least 2 titrations which are counted<br>indicates results which are counted<br>titre volumes to 0.05 cm <sup>3</sup>  | <b>3 scoring points</b><br><b>all 3 = 1 mark</b> |
| <b>Notes</b>   | <i>* ignore zero entries</i><br><i>* allow one other error</i>   |  |
| (d) the <b>concordancy</b>   | concordant if two results are within 0.1 cm <sup>3</sup> of each other   | <b>1 mark</b>                                    |
| <b>Notes</b>   | <i>* award the mark for concordancy if the table contains at least two concordant results</i>  |  |
| (e) The <b>accuracy</b> of the mean value, measured against a teacher value for the titration. |  |  |
| mean titre is within 1% of target value  | 3 marks  | <b>3 marks</b>                                   |
| mean titre is within 1.5 % of target value   | 2 marks  |  |
| mean titre is within 2% of target value  | 1 mark   |  |
| <b>Notes</b>   | <i>* ensure average titre is calculated correctly</i><br><i>* if value entered by the candidate is wrong, underline the wrong value and write the correct value by the side</i><br><i>* use the corrected value to assess accuracy</i><br><i>* if staff value is wrong or missing use a group average; complete a discrepancy form</i><br><i>* when calculating a group average ignore wild data</i> |  |

**Exercise 2**      Mark scheme      Skill assessed      **Analysing (3)**

**Skill 3**      **Analysing**

Question 1       $6\text{Fe}^{2+} + \text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+ \rightarrow 6\text{Fe}^{3+} + 2\text{Cr}^{3+} + 7\text{H}_2\text{O}$       **1 mark**

Question 2      calculates a mean titre for the original mixture      17.50 cm<sup>3</sup>      **1 mark**

Question 3      moles of dichromate(VI)       $2.975 \times 10^{-4}$   
 moles of iron(II)       $1.785 \times 10^{-3}$       **1 mark**

**Notes**  
 \* *Consequential marking from Q2*  
 \* *Average of all four titres is 17.56*  
 \* *Using 17.56 gives  $2.985 \times 10^{-4}$  and  $1.791 \times 10^{-3}$*

Question 4      calculates a mean titre for the second mixture      23.70 cm<sup>3</sup>  
 moles of dichromate(VI)       $4.029 \times 10^{-4}$   
 moles of iron(II)       $2.417 \times 10^{-3}$       **1 mark**

**Notes**  
 \* *Consequential marking from average titre*

Question 5      calculates ratio of moles / titres      ( 73.8 % )      **1 mark**  
**Notes**  
 \* *Consequential marking from average titres*  
 \* *Using 17.56 gives 74.1%*

Question 6      calculates pipette error 0.05 in 25 = 0.2%      3 scoring points  
 calculates burette error 0.15 in 17.5 = 0.86%      any 2 = **1 mark**  
 calculates overall error = 1.1%

**Notes**  
 \* *Allow 1% or 1.157%*  
 \* *Consequential marking for overall error*  
 \* *Penalise doubled errors once*  
 \* *loses mark if (x 100) missing from calculations;*  
*don't penalise again in awarding the nomenclature mark*

**Precision**      quotes average titre for original mixture to 2 dec places      4 scoring points  
 quotes average titre for filtered mixture to 2 dec places      any 3 = **1 mark**  
 quotes solution concentration to 2 sig figs or 3 dec places  
 quotes percentage of iron(II) to 3 sig figs

**Nomenclature**      explains calculations clearly and logically, with a sensible layout      2 scoring points  
 uses terminology accurately      **both = 1 mark**

**Notes**  
 \* *incorrect units mean the nomenclature mark is lost*  
 \* *don't penalise missing units*

**Total = 8 marks**

**Exercise 2**      Mark scheme      Skill assessed      **Evaluating (4)**

Question 1      three good results (and one close) in first series  
four good results in second series  
so titration technique good/ results consistent/ concordant      3 scoring points  
any 2 = 1 mark

Question 2      difference is 4.2  
4.2 against 78 is a 5.4% error      2 scoring points  
both = 1 mark

**Notes** \* *Consequential marking from Q5 of Analysis*

Question 3      excess zinc reacts with  $\text{Cr}_2\text{O}_7^{2-}/\text{Fe}^{3+}$  formed in titration  
leads to inaccurate titre      1 mark  
1 mark

**Notes** \* *Do not penalise additional answers unless they contradict*

Question 4      lose some solution when filtering / solution wets paper etc  
tiny particles of zinc might get through  
air oxidation of iron(II)      3 scoring points  
any 2 = 2 marks  
any 1 = 1 mark

**Notes** \* *Do not penalise additional answers unless they contradict*

**Total = 6 marks**

**Exercise 3**

Mark scheme

Skill assessed **Planning (1)****(a) the appreciation of scale and precision**

correct reaction equation

( 1:1 )

**max 4 scoring points**

calculates theoretical mass of BCC to make 5g 4-MDM

3.60g

**(s)**

calculates likely mass of BCC to make 5g 4-MDM

5.53g

calculates mass of  $\text{AlCl}_3$  needed

5.30g

**(b) the purification process****(i) apparatus****max 4 scoring points**

container for preparing hot saturated solution

**(a)**

apparatus for heating eg hot water bath, hotplate

apparatus for filtering eg Buchner apparatus

container for the pure crystals incl filter paper

**Notes** \*Can score these marks from a diagram, even if not labelled

\*Ignore additional apparatus unless contradictory, when CE means no points scored in this section

**(ii) method****max 6 scoring points**

dissolves in the minimum quantity

**(m)**

of hot methylbenzene

filters hot

cools hot solution

filters crystals

dries crystals

weighs dry sample

**Notes** \*If method completely unworkable CE means no points scored in this section

\*If method seriously unsafe penalise 1 mark

**(c) the appreciation of safety****max 6 scoring points**

eye protection

**(h)**

fume cupboard

skin protection or flood affected area with water

aware of toxicity hazard with the methylbenzene

aware of toxicity hazard with unknown organic

care when heating / avoid naked flames

**GRADING** Total 20 scoring points

18-20 points scores 8 marks

16-17 points scores 7 marks

14-15 points scores 6 marks

12-13 points scores 5 marks

10-11 points scores 4 marks

7-9 points scores 3 marks

4-6 points scores 2 marks

1-3 points scores 1 mark