AQA

Mark scheme

June 2003

GCE

Chemistry

Unit CHM6/P

CHM6/P   June 2003

Exercise 1   Mark scheme   Skill assessed **Implementing** (2)

1. <u>Points assessed by supervisor **during the practical examination**</u>

(a) (i) use of the **pipette**

1 empties under gravity
2 transfers from pipette without spillage   9 scoring points
3 touches surface with pipette

(ii) use of the **burette**

4 uses thio in burette, and iodate in the pipette   any 7 = **2 marks**
5 removes the funnel before titrating   any 4 = **1 mark**
6 dropwise addition near the endpoint
7 swirls mixture
8 reads burette correctly

(iii) general

9 does not require additional sample

2. <u>Points assessed from candidate's **written report**.</u>

(b) the **recording** of results   results recorded clearly and in full in the table   **1 mark**
     Notes   * *if you can read it, it is clear*
                   * *full means completes at least two columns correctly*

(c) the awareness of **precision**   at least **2** titrations which are counted   3 scoring points
                                             indicates results which are counted   **all 3 = 1 mark**
                                             titre volumes to 0.05 cm^3
     Notes   * *ignore zero entries*
                   * *allow **one** other error*

(d) the **concordancy**   concordant if two results are within 0.1 cm^3 of each other   **1 mark**
     Notes   * *award the mark for concordancy if the table contains at least two*
                   concordant results

(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
     Notes   * *ensure average titre is calculated correctly*
                   * *if value entered by the candidate is wrong, underline the wrong value*
                     and write the correct value by the side
                   * *use the corrected value to assess accuracy*
                   * *if staff value is wrong or missing use a group average; complete a*
                     discrepancy form
                   * *when calculating a group average ignore wild data*

Total 8 marks

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

Skill 3   <u>**Analysing**</u>

Question 1 $6Fe^{2+} + Cr_2O_7^{2-} + 14H^+ \rightarrow 6Fe^{3+} + 2Cr^{3+} + 7H_2O$ **1 mark**

Question 2   calculates a mean titre for the original mixture $17.50 \ cm^3$ **1 mark**

Question 3   moles of dichromate(VI) 2.975×10^{-4}

                 moles of iron(II) 1.785×10^{-3} **1 mark**

Notes   ** Consequential marking from Q2*

          * Average of all four titres is 17.56

          * Using 17.56   gives 2.985×10^{-4} and 1.791×10^{-3}

Question 4   calculates a mean titre for the second mixture $23.70 \ cm^3$

                 moles of dichromate(VI) 4.029×10^{-4}

                 moles of iron(II) 2.417×10^{-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   3 scoring points
            four good results in second series   **any 2 = 1 mark**
            so titration technique good/ results consistent/ concordant

Question 2   difference is 4.2   2 scoring points
            4.2 against 78 is a 5.4% error   **both = 1 mark**
      Notes   ** Consequential marking from Q5 of Analysis*

Question 3   excess zinc reacts with $Cr_2O_7^{2-}$/ Fe^{3+} formed in titration   **1 mark**
            leads to inaccurate titre   **1 mark**
      Notes   ** Do not penalise additional answers unless they contradict*

Question 4   lose some solution when filtering / solution wets paper etc   3 scoring points
            tiny particles of zinc might get through   **any 2 = 2 marks**
            air oxidation of iron(II)   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 $AlCl_3$ needed	5.30g	

(b) the **purification process**

(i) apparatus   **max 4** scoring points

                                                                               (a)

container for preparing hot saturated solution
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

                                                                        (h)

eye protection
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