



**General Certificate of Education**

**Chemistry 5421**

**CHM3/P Practical Examination**

**Mark Scheme**

*2007 examination - June series*

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**CHM3/P****Exercise 1**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                           | 10 scoring points                         |
|                                   | 2 transfers from pipette without spillage         |   |
|                                   | 3 touches surface with pipette                    |   |
| (ii) use of the <b>burette</b>    | 4 uses alkali in burette, and acid in the pipette | any 8 <b>including</b><br>works safely    |
|                                   | 5 removes the funnel before titrating             |   |
|                                   | 6 dropwise addition near the endpoint any         | <b>= 2 marks</b><br>any 5 = <b>1 mark</b> |
|                                   | 7 swirls mixture                                  |   |
| (iii) general                     | 8 reads burette correctly                         |   |
|                                   | 9 does not require additional sample              |   |
|                                   | 10 works safely                                   |   |

**Notes** \* if there is a blank space on the teacher's grid, assume candidate did not score that point  
 \* if the Works Safely column is blank ask AQA to contact centre for an explanation

**2. Points assessed from candidate's written report.**

- (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  
 \* allow clear answer outside of the box  
 \* lose this mark if initial titre recorded as 50.00 cm<sup>3</sup>

- (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<sup>3</sup>

**Notes** \* ignore all zero entries  
 \* allow **one** other error  
 \* ignore precision of average titre

- (d) the **concordancy** concordant if two results are within 0.10 cm<sup>3</sup> of each other **1 mark**

**Notes** \* award this mark if the table contains at least **two** concordant results

- (e) The **accuracy** of the mean value, measured against a teacher value for the titration. **3 marks**  
 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

**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*
- \* *if initial titre recorded as 50.00 cm<sup>3</sup> mark titres as recorded by candidate; check with Team Leader if an alternative interpretation would help*

**Total 8 marks**

**Exercise 2**

Skill assessed **Analysing (2)**

- Q1** plots points for 0-4 minutes correctly  
 plots points for 5-10 minutes correctly  
 straight line through the points before addition  
 line through the points after addition is smooth  
 best fit  
 extrapolation back is a natural extension of the drawn line  
 reads the temperature rise correctly from the graph
- 7 scoring point  
 any **6 = 2 marks\***  
 any 3 = 1 mark
- \* must include  
 correct extrapolation.

- Notes**
- \* *If graph does not cover half of the paper :-  
 maximum score is 1 mark  
 write **scale** on the candidate's graph  
 mark up to first 3 correct points only  
 do not penalise again under nomenclature*
  - \* *If the graph plot goes off the squared paper maximum score is 1 mark;  
 do not penalise again under nomenclature*
  - \* *If axes unlabelled use data to decide that temperature is on y axis*
  - \* *Allow one incorrectly plotted point in each part*
  - \* *"smooth" means straight for a straight line*
  - \* *give best fit point if the student's extrapolation is close to your extrapolation*
  - \* *"Correct extrapolation" means correct line to 4 minute ordinate*

- Q1** temperature rise 5.8 - 6.0 °C **1 mark**

- Notes** \* *Do **not** allow other answers*

- Q2** 2.42 to 2.51 kJ allow answer in J **1 mark**

- Notes**
- \* *Consequential marking from answer to Q2*
  - \* *Do **not** award this mark if candidate gets the correct answer by an incorrect method; don't penalise again in awarding the nomenclature mark*

- Q3** 4.75 x 10<sup>-2</sup>  
 51.0 to 52.8 kJ mol<sup>-1</sup> 2 scoring points  
**both = 1 mark**

- Notes**
- \* *Consequential marking from answer to Q1*
  - \* *Do **not** award mark if candidate gets a correct answer by an incorrect method; don't penalise again in awarding the nomenclature mark*
  - \* *Ignore sign of ΔH value; ignore in awarding the nomenclature mark*

- Q4 errors**
- |                    |                    |  |
|--------------------|--------------------|--|
| measuring cylinder | 2%                 |  |
| thermometer        | 1.7% based on 5.9° |  |
| total error        | 3.7%               | <b>3 scoring points<br/>any 2 = 1 mark</b> |

- Notes**
- \* *Ignore precision of answers*
  - \* *Consequential marking for thermometer from Q1 and for overall error*
  - \* *Penalise doubled errors **once***
  - \* ***Lose mark** if answers wrong because (x 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. And do **not** penalise in nomenclature*

- (a) The **appreciation of precision**  
 quotes temp rise to 1 dp  
 quotes  $q$  to 3 significant figures **or** integer in answer in J  
 quotes molar enthalpy change to 3 significant figures
- 3 scoring points  
**any 2 = 1 mark**

**Notes** *\* If no answers to Q2 and Q3 can't score this mark*

- (b) The correct use of **nomenclature and terminology**  
**graph has sharp trace**  
**explains the calculations clearly and logically**  
**explains the calculation of the errors clearly**
- 3 scoring points**  
**all 3 = 1 mark**

**Notes**

- \* Graph with broad line or doubled line means mark is lost*
- \* Incorrect units mean the nomenclature mark is lost*
- \* Don't penalise missing units*
- \* **Two** blank sections mean the nomenclature mark is lost*
- \* Answer given in Q 3 or 4 without working means the nomenclature mark is **lost***
- \* **Do not penalise for wrong calculation in Q 3 if explained clearly***

**Total 8 marks**

## **Exercise 2**

Skill assessed **Evaluating (2)**

- Q1.** ignores result at 7 minutes when plotting graph **1 mark**
- good straight line / results consistent or reliable **1 mark**

**Notes**

- \* Allow first point in written answer to Q1 or clearly from the graph; any contradiction on graph **loses** this mark*
- \* Must make a clear written comment for final point*

- Q2.** difference is 3.2 - 4.0 2 scoring points  
 against 55.0 is a 5.8 to 7.3% error **both = 1 mark**

**Notes**

- \* **Lose mark** if no evidence of working in second part*
- \* Ignore precision of answers*
- \* Allow consequential answer from Q3 of Analysis*
- \* Difference must be clearly stated*
- \* **Lose mark** if the candidate answers a different question*
- \* Using 48.5 gives difference is 6.5, and a 11.8% error*

- Q3.** appreciates heat loss main source of error 2 scoring points  
 appropriate improvement to insulation eg lid, more lagging **both = 1 mark**  
 appropriate improvement to calorimeter **or** calculates calorimeter constant

**Notes**

- \* **Lose one mark** if answers to Q3 and Q4 reversed*
- \* Must give details of improvement; "use a better calorimeter" does **not** score point*

**Q4** appropriate source of error eg original temperature of acid & unequal **1 mark**  
 or temperature rise too small

appropriate improvement eg equilibrates reagent temps/ corrects initial temperature **1 mark**  
 or higher reagent concentrations

**Notes** \* *Do not allow "repeats experiment"*

**Total 6 marks**

**Exercise 3** Skill assessed **Planning**

(a) the **scale** of working used **s** max **4** scoring points  
 calculates the  $M_r$  values of  $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$  and  $\text{BaCl}_2$  (244.3 and 208.3)  
 sensible amount of hydrated salt ( $\geq 1\text{g}$  but  $\leq 20\text{g}$ )  
 errors are too great using a small mass owtte  
 difficult to remove all of the water from a large mass

**Notes** \* *quotes  $M_r$  values to 1 dp or loses first point*

(b) the **apparatus** used **a** max **4** scoring points  
 a suitable container e.g. crucible, evaporating basin, beaker, metal tray  
 a method of heating e.g. Bunsen burner, oven  
 support e.g. tripod, stand & clamp  
 a means of safely holding the container e.g. tongs  
 two decimal place or better balance

**Notes** \* *For first point do **not** allow test tube, boiling tube, conical flask*  
 \* *Does not need gauze or pipe-clay triangle to score third point*  
 \* *Can score from a diagram; does not need to be labelled as long as unambiguous*  
 \* *Must specify accuracy of balance to score final point; can award if stated mass to be used clearly indicates 2dp or better*  
 \* *Can score balance point from a list if mentions weighing in the body of the text*  
 \* *Cannot score other apparatus from a list without some mention in the body of the text*

(c) the **method** used **m** max **6** scoring points  
 weighs container  
 adds stated mass of the hydrated salt.  
 reweighs the container and salt  
 heats the container  
 allows container to cool  
 reweighs the container and salt.  
 heats to constant mass  
 records final mass

**Notes** \* *If method completely unworkable CE means no points scored in this section*  
 \* *If method seriously unsafe penalise **1 mark** at end; do not penalise lids on container but do penalise bung*  
 \* *If heat on a water bath can score **first 3 points** only*

(d) the **use of results****r** max **4** scoring points**By moles**

uses mass data to calculate mass of anhydrous salt

uses mass data to calculate mass of water **or** hydrated saltuses  $M_r$  and mass data to calculate the number of moles of  $BaCl_2$  and  $H_2O$  **or**  $BaCl_2$  and  $BaCl_2 \cdot 2H_2O$ appreciates these numbers in the ratio 1:2 **or** 1:1**By percentages**

uses mass data to calculate mass of anhydrous salt

uses mass data to calculate mass of water **or** hydrated saltuses  $M_r$  and mass data to calculate the percentage of  $H_2O$  **or**  $BaCl_2$  in hydrated saltappreciates these numbers should be 14.7 **or** 85.3% of original mass

**Notes** \* *Candidate can use invented figures or algebra but **must** show each step unambiguously using relevant data. Vague statements such as "use the results to calculate the moles of  $BaCl_2$  formed" do **not** score the point*

(e) the **appreciation of likely hazards and safety precautions****h** max **2** scoring points

barium salts toxic

gloves/wash spillages

eye protection **or** care needed handling hot objects**Notes** \* *Need hazard **and** sensible precaution for point 1; do **not** allow "do not eat"*

<b>GRADING</b>	19 - 20	scores	8 marks	9 - 10	scores	4 marks
	16 - 18	scores	7 marks	6 - 8	scores	3 marks
	14 - 15	scores	6 marks	3 - 5	scores	2 marks
	11 - 13	scores	5 marks	1 - 2	scores	1 mark

**Total 8 marks**