

# General Certificate of Education

## Chemistry 6421

*CHM6/P Practical Examination*

# Mark Scheme

*2006 examination - June series*

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

## CHM6/P

### Exercise 1 Skill assessed **Implementing** (8)

1. Points assessed by supervisor during the practical examination

(a) (i) <b>test tube reactions</b>	1	uses appropriate quantities	7 scoring points
	2	no spillages	any 6 including
	3	shakes mixture	safety = <b>2 marks</b>
(ii) use of the <b>water bath</b>	4	water bath set up correctly	any 4 = 1 mark
	5	appropriate volume of water	
(iii) <b>general</b>	6	does not require additional sample	
(iv) <b>safety</b>	7	works safely - eye protection, no spillage	

2. Points assessed from candidate's written report.

(b) the **recording** of results results recorded clearly in the table **1 mark**

**Notes**

- *If you can read it, it is clear*
- **Full means completes at least 14 boxes**

(c) the **accuracy** of the observations. 21 scoring points

19 - 21	points scores	<b>5 marks</b>
15 - 18	points scores	4 marks
11 - 14	points scores	3 marks
6 - 10	points scores	2 marks
1 - 5	points scores	1 mark

**Notes**

- *Check the teacher observations against the published grid, noting any significant discrepancies*
- *Keep these discrepancies in mind when marking the scripts; allow **either** the published answer **or** the teacher alternative*
- *Look for the basic colour; ignore additional shades if the answer is unambiguous*
- *Accept **suspension, sediment, solid deposit** as well as precipitate no change, no reaction, stays the same as well as no visible change no further change, precipitat remains, stays the same, a colour change in the ppt as equivalent to precipitate insoluble in excess*
- *Compound D, Test 1a (NaOH and Zn<sup>2+</sup>) if teacher records “no visible change”, **and** all candidates record “no visible change”, allow **one** scoring point*

**Total 8 marks**

## Question 1

	<b>Co<sup>2+</sup></b>	<b>Fe<sup>2+</sup></b>	<b>Cu<sup>2+</sup></b>	<b>Zn<sup>2+</sup></b>
Test	Observation with Compound A	Observation with Compound B	Observation with Compound C	Observation with Compound D
1a Addition of sodium hydroxide solution	blue ppt (1) insoluble in excess (1)	green ppt (1) insoluble in excess (1)	blue ppt (1) insoluble in excess (1)	white ppt (1) soluble in excess or colourless solution (1)
1b Heating the mixture from Test 1	ppt turns pink or grey (1)	ppt darkens / turns dark green / red brown	ppt turns black or brown (1)	no visible change (1)
2. Addition of potassium thiocyanate solution	no visible change (1)	yellow / orange solution (1)	green solution (1) white ppt on standing (1)	no visible change (1)
3. Addition of potassium hexacyanoferrate(II) solution	green ppt (1)	blue ppt (1)	brown ppt (1)	white ppt (1)

**Exercise 2** Skill assessed **Analysing** (8)

Q 1  $5\text{H}_2\text{O}_2 + 2\text{MnO}_4^- + 6\text{H}^+ \rightarrow 5\text{O}_2 + 2\text{Mn}^{2+} + 8\text{H}_2\text{O}$  **1 mark**

**Notes**

- Do **not** allow other answers
- If equation incorrect/ missing candidate loses this mark **and** mark for Q3; allow consequential marking for Q4 and 5

Q 2 calculates a mean titre for the original mixture 27.87 (cm<sup>3</sup>) **1 mark**

**Notes**

- Do **not** allow other answers

Q 3 (moles of manganate(VII) *ave titre x 0.02/1000*  $5.576 \times 10^{-4}$ )  
 moles of hydrogen peroxide *2.5 x moles MnO<sub>4</sub><sup>-</sup>*  $1.394 \times 10^{-3}$  (mol) **1 mark**

**Notes**

- Consequential marking from answer to Q2
- Ignore precision of answers
- If equation incorrect/ missing in Q1 candidate **loses** mark for Q3; allow consequential marking for Q4 and 5

Q 4 moles of H<sub>2</sub>O<sub>2</sub> in 250 cm<sup>3</sup> *ans from Q3 x 10*  $1.394 \times 10^{-2}$   
 molarity of original solution *moles H<sub>2</sub>O<sub>2</sub> x 40* 0.558 (mol dm<sup>-3</sup>) **1 mark**

**Notes**

- $1.45 \times 10^{-3}$  gives  $1.45 \times 10^{-2}$  and 0.580
- Consequential marking from answer to Q3

Q 5 conc of original solution *ans from Q4 x 34* 19.0 (g dm<sup>-3</sup>) **1 mark**

**Notes**

- Consequential marking from answer to Q4

Q 6 calculates vol. flask error 1 in 250 = 0.4% 4 scoring points  
 calculates pipette error 0.1 in 25 = 0.4% any 3 = **1 mark**  
 calculates burette error 0.15 in 27.87 = 0.5%  
 calculates overall error = 1.3(4)%

**Notes**

- Ignore precision of answers
- Consequential marking for burette volume from Q2 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 (balance, syringe). And do **not** penalise in nomenclature

**Precision (p)** quotes average titre to 2 dec places Q2 3 scoring points  
 quotes solution concentration to 3 sig figs Q4 **all 3 = 1 mark**  
 quotes concentration in g dm<sup>-3</sup> to 3 sig figs Q5

**Notes**

- If no answer in Q 5 can still score this mark if precision in Q 2 and 4 are correct

**Nomenclature (n)** explains calculations clearly and logically, with a sensible layout      3 scoring points  
uses terminology accurately      **all 3 = 1 mark**  
units where used are correct

**Notes**

- *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 2 to 6 without working means the nomenclature mark is **lost***

**Total = 8 marks**

**Exercise 2** Skill assessed **Evaluating(6)**

- Q 1 clearly states first titre is not concordant/ outside tolerance/ rough 2 scoring points  
or clearly states that 2, 3 and 4 are concordant any 1 = 1 mark  
so titration technique good/ results consistent/ reliable/ use with confidence 1 mark

**Notes**

- Can score first point from part 2 of the Analysis but must be clearly stated

- Q2 difference is 0.257 2 scoring points  
0.257 against 0.815 is a 31.5 % error both = 1 mark

**Notes**

- *Lose mark if no evidence of working in second part*
- *Ignore precision of answers*
- *Allow consequential answer from part 5 of Analysis*
- *Difference must be clearly stated*
- *Lose mark if the candidate answers a different question*
- *Using 0.515 gives difference is 0.3, and a 36.8% error*

- Q 3 appreciates discrepancy > maximum apparatus error 2 scoring points  
some procedural error/ operator error both = 1 mark

**Notes**

- *Must make a clear written statement linking both points to score mark*

- Q 4 hydrogen peroxide has decomposed 1 mark  
KMnO<sub>4</sub> was more concentrated than 0.020 mol dm<sup>-3</sup> 4 scoring points  
solution made beyond the mark any 1 = 1 mark  
consistent burette misread  
volume of KMnO<sub>4</sub> hard to read accurately

**Total 6 marks**

**Exercise 3** Skill assessed **Planning (8)**(a) The **scale** of working used (s) **max 3 scoring points**

(s)

states appropriate volume of gas to be collected *allow 20-250 cm<sup>3</sup>*  
 calculates moles of nitrogen *25 cm<sup>3</sup> gas = 1.03 x 10<sup>-3</sup> mol*  
 calculates volume of solution needed *25 cm<sup>3</sup> gas = 10.3 cm<sup>3</sup> soln*  
 correct dilution for second concentration

**Notes**

- *Allow consequential marking from volume chosen*
- *Allow calculations based on 1 mol = 24 dm<sup>3</sup>*

(b) The **apparatus** used (a) **4 scoring points**

appropriate container for reaction *any stoppered vessel with gas outlet*  
 appropriate collection of gas *over water or in a syringe*  
 apparatus for measuring volume of solution *allow measuring cylinder, pipette, burette*  
 thermostatic control of whole mixture or water bath

**Notes**

- *Can score these points from a diagram but **not** from a list*
- *Ignore additional apparatus if doesn't affect result*

(c) The **method** used (m) **6 scoring points**

measures out specified volume of solution  
 keeps mixture at 20 °C *can score from diagram*  
 takes volume readings **or** measures time taken  
 at suitable time intervals to collect a specified volume of gas  
 experiments with at least two concentrations *allow any second concentration*  
 dilutes original solution

**Notes**

- *if no volume calculated in part 2 then allow measure solution; if volume mentioned in part 2 must measure this volume*

(d) The **use of results** (r) **max 3 scoring points**

(i) measures volumes at regular intervals  
 plots sensible sketch graph of volume versus time  
 clear correct explanation of calculation of rate from graph *tangent to curve/ gradient of linear section*

clear correct explanation of use of rate data to establish first order relationship

**OR** (ii) measures times taken to collect specified volume  
 obtains results for at least two different concentrations  
 clear correct explanation of use of rate data to establish first order relationship

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

phenol toxic/corrosive wash spillages with cold water/ wear gloves  
 eye protection/pipette filler

**Notes**

- *Need hazard and precaution for point 1*
- *Two precautions without reference to a chemical hazard score 1 point only*

**GRADING**

20 scoring points

16 - 18	scores	8 marks	8 - 9	scores	4 marks
14 - 15	scores	7 marks	6 - 7	scores	3 marks
12 - 13	scores	6 marks	3 - 5	scores	2 marks
10 - 11	scores	5 marks	1 - 2	scores	1 mark