

General Certificate of Education

Chemistry 6421

CHM6P Practical

Mark Scheme

2005 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.

Exercise 1	Mark scheme	Skill assessed	Implementing (2)
1. Points assessed by supervisor during the practical examination			
(a) (i) test tube reactions marks	1	uses appropriate quantities	7 scoring points any 6 including safety = 2
	2	no spillages	
	3	shakes mixture	
	4	water bath set up correctly	any 4 = 1 mark
5	appropriate volume of water		
7	does not require additional sample		
8	works safely - eye protection, no spillage		
2. Points assessed from candidate's written report .			
(b) the recording of results			1 mark
	results -recorded clearly in the table		
Notes	* <i>If you can read it, it is clear</i>		
	* <i>Full means completes at least 11 boxes</i>		
(c) The accuracy of the observations.	12 scoring points	11- 12 points scores	5 marks
		9 - 10 points scores	4 marks
		6 - 8 points scores	3 marks
		3 - 5 points scores	2 marks
		1 - 2 points scores	1 mark
			Total 8 marks

- 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*
 - * *If answers contradict e.g. "No visible change with white precipitate" then scoring point is **not** awarded*
 - Look for the basic colour; ignore additional shades if the answer is unambiguous; clear is not the same as white/colourless*
 - * *If centre puts 'orange/yellow' allow 'orange ' or ' yellow '*
 - * *Accept **suspension, sediment, solid deposit** as well as precipitate*
 - * *Do **not** accept "cloudy" or "misty" or "emulsion"*
 - * *Accept **no change, no reaction, stays the same** as well as no visible change*
 - * *If 'precipitate' missing in the answer, penalise each omission*
 - * *If 'solution' missing in the answer, penalise **once***
 - * *Do **not** accept "fizzes"; accept effervescence, bubbles of gas, gas released*

Exercise 2	Mark scheme	Skills assessed	Analysing and Evaluating
Skill 3	Analysing		
Question 1	$K_c = \frac{[\text{CH}_3\text{COOCH}_2\text{CH}_3][\text{H}_2\text{O}]}{[\text{CH}_3\text{COOH}][\text{CH}_3\text{CH}_2\text{OH}]}$		1 mark
Notes	<p>* <i>must be square brackets</i> * <i>Ignore missing "K_c ="</i></p>		
Question 2	moles = 0.42/60 = 0.007		1 mark
Question 3	moles = MV/1000 = 0.5 x 3/1000 = 1.5 x 10 ⁻³ moles acid = 1.5 x 10 ⁻³		both = 1 mark
Question 4	moles acid used = 7 x 10 ⁻³ - 1.5 x 10 ⁻³ = 5.5 x 10 ⁻³ equil moles ester = water = 5.5 x 10 ⁻³		both = 1 mark
Notes	* <i>Allow consequential answer from parts 2 and 3</i>		
Question 5	equil. moles alcohol = 0.01 - 5.5 x 10 ⁻³ = 4.5 x 10 ⁻³		1 mark
Notes	* <i>Allow as number in equation but loses nomenclature point</i>		
	<div style="text-align: center;"> <div style="border: 1px solid black; padding: 2px; width: fit-content; margin: 0 auto 10px auto;">From part 4</div> $K_c = \frac{(5.5 \times 10^{-3})^2}{(1.5 \times 10^{-3})(4.5 \times 10^{-3})} = 4.48$ <div style="display: flex; justify-content: space-around; width: 100%;"> <div style="border: 1px solid black; padding: 2px; width: 15%;">From part 3</div> <div style="border: 1px solid black; padding: 2px; width: 15%;">From part 5</div> </div> </div>		1 mark
Notes	* <i>Allow consequential answers, including wrong moles of ethanol</i>		
Question 6	calculates balance error 0.001 in 0.42 = 0.2(4)% calculates burette error 0.15 in 3.0 = 5.0(0)%		3 scoring points all 3 = 1 mark
Notes	<p>calculates overall error = 5.2(4)%</p> <p>* <i>Ignore precision of answers</i> * <i>Which error being calculated is not stated; allow if the calculations are in the same order as in the question (balance, burette). And do not penalise in nomenclature</i> * <i>Errors are given without working; allow if correct but lose nomenclature point</i></p>		

Precision and Nomenclature mark	quotes K_c value to 3 sig figs explains calculations clearly and logically, with a sensible layout	4 scoring points any 3 = 1
Notes	uses terminology accurately units where used are appropriate <i>* Incorrect units mean a nomenclature point is lost</i> <i>* Don't penalise missing units</i> <i>* Two blank sections mean the nomenclature mark is lost</i> <i>* Answer given in part 2, 3, 4, or 5 without working means a nomenclature point is lost for each omission</i>	

Total = 8 marks

Skill 4	<u>Evaluating</u>	
Question 1	difference is 0.56 0.56 against 3.92 is a 14.3% error	2 scoring points both = 1 mark
Notes	* Lose mark if no evidence of working in second part * Ignore precision of answers * Allow consequential answer from part 4 of Analysis * Difference must be clearly stated * Lose mark if the candidate answers a different question * Using 3.40 gives 0.52 and 13.3%	
Question 2	discrepancy > apparatus error equilibrium disturbed/ some procedural error/ operator error	2 scoring points both = 1 mark
Notes	* Must make a clear written statement linking both points to score mark	
Question 3	0.05M to 0.1M	1 mark
Notes	larger volume reduces burette error/ gives more accurate endpoint * Must justify concentration to score second mark – correct link between their suggested concentration and the expected titre	1 mark
Question 4	K_c / equilibrium position temperature dependant water bath thermostatted or maintained at a constant temperature	1 mark 1 mark
		Total = 6 marks

Skill assessed Planning (8 marks)

- (a) the **scale** of working used max 5 scoring points (s)
 balanced eqn $5\text{H}_2\text{O}_2 + 2\text{MnO}_4^- + 6\text{H}^+ = 5\text{O}_2 + 2\text{Mn}^{2+} + 8\text{H}_2\text{O}$
 M_r of hydrogen peroxide is 34
 original conc is 1.18 M
 appreciates peroxide should be about 0.05 M
 dilute by about 20 to 25 times for a 25 cm³ titre

Notes * To score last two points need a definite **correct** link between titration conc and dilution
 * Don't accept equations with H^+ on each side

- (b) the **titration** max 9 scoring points (m)
 appropriate rinsing *award for any correct rinsing; any incorrect rinsing loses this point*
 pipette 25 cm³ of peroxide into conical *allow peroxide in the burette*
 adds sulphuric acid *volume not needed but if given must be appropriate (5cm³ or more)*

adds standard manganate(VII) from burette
 swirls

dropwise at end point

to first permanent pink tinge *pink colour disappears if peroxide in the burette*

note burette reading

repeats titration

at least 2 concordant results

two standard precautions for an accurate result *allow remove funnel, read from bottom of meniscus, white tile, illuminate burette when reading, fill jet space, pipette empties under gravity, touch pipette*

on surface of liquid, wash sides of flask, white markings on burette

Notes * Can score points from a diagram
 * Ignore additional apparatus unless contradictory - lose apparatus point(s)
 * Ignore addition of indicator
 * If no sulphuric acid added maximum m=6
 * If mixture heated maximum m=6; if boiled maximum m=6 and lose **1 mark** for unsafe
 * If method unworkable mark up to point where method fails; write CE at this point
 * If method seriously unsafe penalise **1 mark**

- (c) the **use of results** max 4 scoring points (r)
 calculate moles of manganate(VII)
 multiplies moles of hydrogen peroxide as moles of manganate(VII) x 2.5

calculate molarity of diluted solution by scaling up by appropriate factor

correct scaling for molarity of original solution by scaling up with candidates dilution

Notes * Allow any correct alternative method of calculation
 * Allow consequential errors on equation and scaling factor
 * Some correct number work where possible is required to score these points; do not credit general statements which do not use candidates own figures or data from question

- (e) the **appreciation of likely hazards and safety precautions** max 2 scoring points (h)
 hydrogen peroxide irritant linked to eye protection/ pipette filler
 sulphuric acid corrosive linked to gloves/ flood affected area
 manganate(VII) oxidising linked to avoid flammable materials

Notes

- * *Need hazard and precaution to score point*
- * *Allow hydrogen peroxide linked to gloves etc and sulphuric acid linked to eye protection but must mention two hazards and two linked precautions to score two points*
- * *For list of hazards **and** precautions without links allow h=1*

GRADING

20 scoring points	18 - 20	scores	8 marks	10 - 11	scores	4 marks
	16 - 17	scores	7 marks	7 - 9	scores	3 marks
	14 - 15	scores	6 marks	4 - 6	scores	2 marks
	12 - 13	scores	5 marks	1 - 3	scores	1 mark

8 marks

Question 1

glucose**iron(II) sulphate****hydrochloric acid**

Test	Observation with Compound A	Observation with Compound B	Observation with Compound C
Reagent 1 Benedict's solution	red/orange precipitate	red/orange precipitate	effervescence
Reagent 2 acidified potassium manganate(VII) solution	brown precipitate	colourless solution	colourless solution(on heating)
Reagent 3 sodium hydrogen-carbonate	no visible change	brown precipitate	effervescence
Reagent 4 phenol red	no visible change/ red solution	yellow solution	orange/yellow solution

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