

**MARK SCHEME for the May/June 2010 question paper
for the guidance of teachers**

9791 CHEMISTRY

9791/04

Paper 4 (Practical), maximum raw mark 40

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

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CIE is publishing the mark schemes for the May/June 2010 question papers for most IGCSE, Pre-U, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.



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Skill	Total marks	Breakdown of marks		Qu. 1	Qu. 2	Qu. 3
Manipulation, measurement and observation	17 marks	Successful collection of data and observations	13 marks	2	8	3
		Quality of measurements or observations	2 marks	2	0	0
		Decisions relating to measurements or observations	2 marks	0	2	0
Presentation of data and observations	6 marks	Recording data and observations	2 marks	2	0	0
		Display of calculations and reasoning	2 marks	2	0	0
		Data layout	2 marks	1	0	1
Analysis, conclusions and evaluation	17 marks	Interpretation of data or observations and identifying sources of error	5 marks	5	0	0
		Drawing conclusions	10 marks	1	6	3
		Suggesting improvements	2 mark	2	0	0

MMO = manipulation, measurement and observation
collection = successful collection of data and observations
quality = quality of measurements or observations
decisions = decisions relating to measurements or observations

PDO = presentation of data and observations
recording = recording data and observations
display = display of calculations and reasoning
layout = data layout

ACE = analysis, conclusions and evaluation
interpretation = interpretation of data or observations and identifying sources of error
conclusions = drawing conclusions
improvements = suggesting improvements

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The examiner is to check (and correct if necessary) all subtractions on the Supervisor and candidate scripts where accuracy marks are concerned.

When awarding accuracy marks in Question 1 the candidate's value for the ratio of corrected mass water: corrected mass residue should be listed on the blank page of the Supervisor script or on a sheet of paper securely attached to it.

Where Supervisor results are considered to be suspect (fewer than half the candidates score more than 1 mark), a value derived from the consistent results of the candidates may be used.

		Sections	Learning outcomes	Indicative material	Mark
1	(a)	PDO layout	Use the appropriate presentation medium to produce a clear presentation of the data	All balance readings clearly shown in a single table including mass of residue and mass of water lost	[1]
		PDO recording	Record raw readings of a property to the same degree of precision	All values of mass given to the same number of decimal places	[1]
		PDO recording	Use column headings that include both the quantity and the unit and that conform to accepted scientific conventions	All masses are labelled clearly with units. Must use solidus, brackets or describe units fully in words.	[1]
		MMO collection	Follow instructions given in the form of written instructions or diagrams	Final masses within 0.05 g (Award 1 mark if readings within 0.10 g)	[2]
		ACE interpretation	Calculate other quantities from data	Calculates correctly the mass of water and mass of residue (Examiner to note corrected values)	[1]
		MMO quality	Make accurate and consistent measurements and observations	Examiner to check/calculate the ratio of corrected mass water: corrected mass residue. Award 2 marks if difference is within ± 0.05 of Supervisor value Award 1 mark if difference is within ± 0.10 of Supervisor value.	[2]

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	(b)	PDO display	Show their working in calculations, and the key steps in their reasoning	Mass of residue/120.4	[1]
		PDO display	Show their working in calculations, and the key steps in their reasoning	Mass of water/18.(0)	[1]
		ACE interpretation	Calculates other quantities from data	Calculates ratio of moles water to moles of magnesium sulfate	[1]
		ACE conclusion	Draw conclusions from interpretations of observations, data and calculated values.	States x as an integer	[1]
	(c) (i)	ACE interpretation	Estimate, quantitatively the uncertainty in quantitative measurements	± 0.005 g (or 0.0005 g) (Allow ± 0.01 g (or 0.001g) as long as this value is not doubled in (ii))	[1]
	(c) (ii)	ACE interpretation	Express such uncertainty in a measurement as an actual or percentage error	Value from (c)(i) $\times 2$ ANS / mass of water $\times 100$	[1] [1]
	(d)	ACE improvement	Suggest modifications to an experimental arrangement that will improve the accuracy of the experiment	Any sensible answer with explanation. e.g. more gentle heating or use of lid during the early stages of heating to reduce loss of solid	[1] [1]

[Total: 17]

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FA 2: NaOH FA 3: K₂CrO₄ FA 4: H₂SO₄ FA 5: BaCl₂ FA 6: Pb(NO₃)₂

2	(a)	MMO collection	Use their apparatus to collect an appropriate quantity of data or observations, including differences in colour, solubility or quantity of materials	<p>Observation for FA 2: white ppt with FA 6 (award only if no reaction recorded with FA 3, FA 4 and FA 5. Ignore slight ppt if recorded with FA 5)</p> <p>ppt is soluble in excess</p> <p>Observations for FA 3: turns orange in FA 4</p> <p>yellow ppt with FA 5</p> <p>bright yellow ppt with FA 6 (must have a comparison between the 2 yellow ppts)</p> <p>Observations for FA 4 white ppt with FA 5 white ppt with FA 6</p> <p>Observation for FA 5: white ppt with FA 6</p>	<p>[1]</p> <p>[1]</p> <p>[1]</p> <p>[1]</p> <p>[1]</p> <p>[1]</p> <p>[1]</p>
	(b)	ACE conclusion	Draw conclusion from interpretation of observations	<p>H⁺: FA 4</p> <p>CrO₄²⁻: FA 3</p> <p>SO₄²⁻: FA 4</p> <p>Pb²⁺: FA 6</p> <p>Ba²⁺: FA 5</p> <p>OH⁻: FA 2</p>	<p>[1]</p> <p>[1]</p> <p>[1]</p> <p>[1]</p> <p>[1]</p> <p>[1]</p>
	(c)	MMO decision	Identify where confirmatory tests are appropriate and the nature of such tests	<p>Heat with hydroxide and aluminium foil and test gas with damp red litmus paper</p> <p>No pale brown gas liberated by dilute acids</p>	<p>[1]</p> <p>[1]</p>
				[Total: 16]	

FA 7: butanal FA 8: butan-1-ol FA 9: butanone

3	(a)	PDO layout	Use the appropriate presentation medium to produce a clear presentation of the data	Draws up a clear table showing at least 3 observations	[1]												
		MMO collection	Use their apparatus to collect an appropriate quantity of data or observations, including differences in colour, solubility or quantity of materials	Observations for FA 7 : colour change to green with acidified dichromate (not green ppt) AND silver mirror / black or dark brown solution or ppt with Tollens'	[1]												
		<table border="1"> <thead> <tr> <th></th> <th>dichromate</th> <th>Tollens'</th> </tr> </thead> <tbody> <tr> <td>FA 7 butanal</td> <td>✓</td> <td>✓</td> </tr> <tr> <td>FA 8 butan-1-ol</td> <td>✓</td> <td>x</td> </tr> <tr> <td>FA 9 butanone</td> <td>x</td> <td>x</td> </tr> </tbody> </table>			dichromate	Tollens'	FA 7 butanal	✓	✓	FA 8 butan-1-ol	✓	x	FA 9 butanone	x	x	Observations for FA 8 : colour change to green with acidified dichromate (not green ppt but do not penalise again if mentioned in test for FA 7) AND no reaction with Tollens'	[1]
	dichromate	Tollens'															
FA 7 butanal	✓	✓															
FA 8 butan-1-ol	✓	x															
FA 9 butanone	x	x															
				Observations for FA 9 : no reaction with either reagent													
	(b)	ACE conclusion	Draw conclusion from interpretation of observations	FA 8 is butan-1-ol Must refer to positive test with dichromate and no reaction with Tollens'	[1]												
				FA 7 is batanal Sufficient to refer only to positive result with Tollens' so long as positive test was observed with dichromate and no other positive tests for Tollens' were observed	[1]												
				FA 9 is butanone Sufficient to refer only to negative result with dichromate so long as no reaction with Tollens' was observed and no other negative results are recorded for dichromate. No ecf. Explanation must be based on correct observations	[1]												

[Total: 7]