UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2006 question paper

9701 CHEMISTRY

9701/05 Paper 5 (Practical Test), maximum raw mark 30

This mark scheme is published as an aid to teachers and students, 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.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

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

The grade thresholds for various grades are published in the report on the examination for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses.

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1 Give **one mark** if the temperature of solutions **FB 1** and **FB 2** and all maximum temperatures are recorded to one decimal place.
Withhold this mark if temperatures are recorded to 2 decimal places.

Give **one mark** if the average temperature, correct to 1 decimal place, has been calculated for **FB 1** and **FB 2** ***(do not penalise decimal places twice)***
and
the temperature rise for 0.07 mole (or 0.04 mole if appropriate) has been correctly calculated.

[2]

Accuracy

Record the Supervisor's standard, ringed, below the temperature rise box for experiment 2 (or experiment 5 if more appropriate).

Compare the candidate's temperature rise (corrected if necessary) for experiment 2 (or experiment 5 if more appropriate) with that obtained by the Supervisor.

Award marks as follows:

difference in ΔT / °C	mark
0 to 0.5	4
0.5+ to 1.0	3
1.0+ to 2.0	2
2.0+ to 3.0	1
Greater than 3.0	0

[4]

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(a) Check the plotting of points for **0.08, 0.07, 0.04 and 0.03** mole of sodium hydroxide.

Give **two marks** if all four points have been correctly plotted.

Deduct one mark (no negative marks) for each point that has been incorrectly plotted.

Points that are on a vertical line of the grid (moles of NaOH) must be placed on the line – check the position of the centre of the cross or dot.

(Penalise an error in the precision of placing an otherwise correct point only once)
If uncertain about the position of the centre of a cross or dot check the other plotted points. Apply the penalty if there are two or more uncertainties

points on the y-axis (Δ**T**) should be plotted in the correct small square and within ½ small square of the position determined by the Examiner.

Also **deduct** from these two plotting marks (no negative marks) **one mark** for **each** of the following graphical errors:

(i) moles of NaOH plotted on y-axis and Δ**T** plotted on the x-axis
(ii) measured temperature (**T**) plotted instead of Δ**T**
(iii) points are plotted in less than 4 large squares on either axis **or** an inappropriate scale has been selected.

[2]

(b) Give **one mark** if two straight lines have been drawn through the points and intersect.
Accept two straight lines that meet (and stop) providing there is no free-hand drawing where the lines meet.

Do not give this mark if curves have been drawn.

If solutions have been carefully prepared there should be 3 points on each straight line with an end point between 0.05 and 0.06 mole of sodium hydroxide.

[1]

(c) Give **one mark** for correctly reading (correct to ½ small square) the moles of sodium hydroxide at the end-point from the graph.

Accept a value from the intersection of
any two straight lines **or**
curves **or**
the maximum of the graph if the two lines have been rounded.

[1]

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(d) Give **one mark** for correctly calculating the volume of sulphuric acid at the end-point:

Reacting Quantities	
moles of NaOH	volume of H_2SO_4 / cm^3
0.08	10
0.07	15
0.06	20
0.05	25
0.04	30
0.03	35

[1]

Three ways of calculating the volume of H_2SO_4

(i) **Volume of H_2SO_4 = 50 - $\frac{40}{0.08}$ x moles NaOH from graph**

(ii) by inspection:

moles NaOH	**0.050**	0.052	0.054	0.056	0.058	**0.060**
Volume H_2SO_4 /cm^3	**25.00**	24.00	23.00	22.00	21.00	**20.00**

(iii) calculates the volume of sodium hydroxide

$\frac{\textbf{2.0 x volume}}{\textbf{1000}}$ **= moles NaOH from graph**, then calculates volume of H_2SO_4

volume of H_2SO_4 = 50 – volume of NaOH

(e) Give **one mark** for **ans (c) x $\frac{1}{2}$**

[1]

(f) Give **one mark** for **ans (e) x $\frac{1000}{\text{ans (d)}}$**

[1]

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Enthalpy change

check and correct if necessary the subtractions in Table 1.3

calculate $\frac{\textbf{rise in temperature}}{\textbf{mass of FB 3}}$ correct to 1 decimal place

record the candidate's value alongside the Supervisor's value.

calculate, and record, the difference between the Supervisor and candidate.

Award accuracy marks as follows:

difference to Supervisor	mark
Up to 0.2	4
0.2+ to 0.4	3
0.4+ to 0.6	2
0.6+ to 1.0	1
Greater than 1.0	0

Deduct one mark from those awarded for accuracy (no negative marks) for **each** of the following:

(i) in Table 1.3, any **mass measurement** has not been recorded to at least two decimal places.
(**This does not apply to a calculated mass of FB 3**.)

(ii) there is a subtraction error in Table 1.3

[4]

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(g) Give **one mark** for **50 x 4.3 x (candidate's temperature rise from Table 1.3) or**

$$\textbf{50 x 4.3 x (candidate's temperature rise from Table 1.3) x } \frac{1}{1000}$$

[1]

(h) Give **one mark** for **either** of these expressions:

(i) $$\textbf{Moles of sodium hydroxide} = \frac{\textbf{mass from Table 1.3}}{40}$$

(ii) $$\textbf{Moles of sulphuric acid} = \frac{50}{1000} \textbf{ x concentration calculated in (f)} \quad \textbf{OR}$$

$$\textbf{Moles of sulphuric acid} = \frac{50}{1000} \textbf{ x 1.5}$$

Give **one further mark** for both expressions and correct statement of the reagent in excess.

If (2 x moles of H_2SO_4) > moles of NaOH then H_2SO_4 is in excess.

If (2 x moles of H_2SO_4) < moles of NaOH then NaOH is in excess.

[2]

(i) Give **one mark** for the following:

If sulphuric acid is stated as in excess in **(h)**,

$$\frac{\textbf{ans (g)}}{\textbf{moles of NaOH from (h)}} \textbf{ x } \frac{1}{1000}$$

If sodium hydroxide is in excess in **(h)**,

$$\frac{\textbf{ans (g)}}{\textbf{moles of } H_2SO_4 \textbf{ from (h)}} \textbf{ x } \frac{1}{1000} \textbf{ x } \frac{1}{2}$$

Do not give this mark unless the numerical value is correctly in kJ.

Give **one mark** if a negative (-ve) sign is shown. *This is an independent mark.* **[2]**

There are 22 marking points in question 1.

Record the marks awarded and cancel any marks in excess of 20, recording 20 Max.

[Total for Question 1 20 marks]

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2 ASSESSMENT OF PLANNING SKILLS.

(a) Give **one mark** for **correct stoichiometry and state symbols** for **malachite**.

$CuCO_3.Cu(OH)_2$ (s) $\rightarrow$ **$2CuO(s) + CO_2(g) + H_2O(g)$**

Give **one mark** for correct **stoichiometry** for **azurite**.

$2CuCO_3.Cu(OH)_2 \rightarrow$ **$3CuO + 2CO_2 + H_2O$** **[2]**

(b) Reward the following points (which are shown in the correct order):

a	Weigh the empty **<u>tube</u>** but **not** for taring the tube *Do not give this mark if for example an evaporating basin has been weighed and used for heating the sample*
b	Weigh the (tube) + mineral **or** Tared (tube) + mineral weighed **or** Known amount of mineral taken
c	Heat the mineral *Do not allow heating using a water-bath*
d	Cool and reweigh
e	(Continue heating and weighing) to constant mass (Reheating/reweighing twice can be accepted as heating to constant mass)

Deduct one mark *from these potential five marks (no negative marks) for* ***any*** *of the following:*

(i) *the points are not awarded in a correct practical sequence* ***or***
(ii) *an unnecessary step (e.g. making a solution) has been introduced* ***or***
(iii) *apparatus has been used at this stage to collect/measure/test the gas(es) given off.*

[5]

(c) (i) point (f) Give **one mark** if:

the correct M_r for Malachite is seen = **221.0** **and**
a calculation determines moles or masses of malachite and copper oxide
or
the correct M_r for Azurite is seen = **344.5** **and**
a calculation determines moles or masses of azurite and copper oxide

(ii) point (g) Give **one mark** if:

the equivalent M_r and calculation is seen for the other mineral **and**
the moles or masses **compared and linked to the equations** to show the identity of the mineral

[2]

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Both marks can be obtained from calculations that start with equal masses of malachite and azurite and show that azurite gives less CuO.

Accept $\frac{\textbf{mass of mineral}}{\textbf{221}}$ *etc where the candidate has "invented" exemplar masses even if the values calculated do not illustrate the ratios from the equation.*

Award point **(g)** *if the correct process has been followed but an incorrect M_r has been used.*

Do NOT give credit for M_r of azurite = 422 Formula of azurite read as $2(CuCO_3.Cu(OH)_2)$

(d) Give **one mark** for any of the following:

(i) measuring the volume of carbon dioxide evolved

(ii) measuring mass of carbon dioxide and water vapour absorbed by soda-lime

(iii) measuring mass of water absorbed by anhydrous calcium chloride, concentrated sulphuric acid or silica gel

(iv) condensing water vapour and weighing the water collected

[1]

[Total for Question 2 10]

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