CAMBRIDGE
INTERNATIONAL EXAMINATIONS

November 2003

GCE A AND AS LEVEL

MARK SCHEME

MAXIMUM MARK: 30

SYLLABUS/COMPONENT: 9701/05

CHEMISTRY
Practical 2

UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate

N.B. Boxed references within this marking scheme relate to the accompanying booklet of Standing Instructions

Question 1

Experiment 1

Tables 1.1 and 1.2

Give **one mark** if all weighings are to at least two decimal places, temperatures to at least one decimal place and the subtraction is correct in each table. (1)

Table 1.2 – Accuracy

Calculate $\frac{\textbf{temperature rise}}{\textbf{mass of FB2}}$ for the Supervisors values – work to 2 d.p. Record this one the front of the Supervisor's script and as a ringed total below Table 1.2 on each Candidate's script.

Calculate the same ratio for each candidate and calculate the difference to the Supervisor value. Award accuracy marks for differences as follows:

Mark	*Difference / °C*
4	0.00 to 0.15
3	0.15+ to 0.20
2	0.20+ to 0.30
1	0.30+ to 0.45
0	Greater than 0.45

(4)

(a) Give **one mark** for **50 x 4.3 x Δt and** **appropriate unit (J/kJ)**
No mass of sodium carbonate to be included. *Ignore sign in* **(a)** (1)

(b) Give **one mark** for a calculation showing moles of HCl and moles of sodim carbonate (correct use of 106) **and**
Reference to 2:1 ratio from the equation (1)

(c) Give **one mark** for $\frac{\textbf{answer to (a)}}{\textbf{correctly calculated moles of } Na_2CO_3}$ **or**

$\frac{\textbf{answer to (a)}}{\textbf{0.5} \times \textbf{moles of HC}l}$ if Na_2CO_3 stated to be in excess

and **one mark** for
an answer correct to 3 significant figures using the numerical values in the expression in **(c)** (or correct value from **(a) and (b)** if no working given in **(c)**)
(Do not penalise use of moles of Na_2CO_3 carried in calculator memory from* (b)*)
and sign consistent with experimental results (+ sign required for endothermic reactions)
and unit (J mol^{-1} or kJ mol^{-1})
The second mark can be given providing the answer to **(a)** has been divided by a value for moles of Na_2CO_3 or moles of HCl calculated by the candidate.(2)

Experiment 2

Table 1.3 and 1.4

Give **one mark** if all weighings are to at least two decimal places, temperatures to at least one decimal place and the subtraction is correct in each table. (1)

Table 1.4 – Accuracy

Calculate $\frac{\textbf{temperature rise}}{\textbf{mass of FB3}}$ for the Supervisor's values – work to 2 d.p. Record this on the front of the Supervisor's script and as a ringed total below Table 1.4 on each Candidate's script.

Calculate the same ratio for each candidate and calculate the difference to the Supervisor's value. Award accuracy marks for differences as follows:

Mark	*Difference / °C*
4	0.00 to 0.11
3	0.10+ to 0.20
2	0.20+ to 0.30
1	0.30+ to 0.50
0	Greater than 0.50

(4)

(d) Give **one mark** for **50 x 4.3 x Δt and** **appropriate unit (J/kJ)**
unless already penalised in **(a)**
Ignore sign in **(d)** (1)

(e) Give **one mark** for $\frac{\textbf{mass of NaHCO}_3}{\textbf{84}}$

Do not penalise a repeat error in calculating M_r
e.g. repeated use of an incorrect A_r (1)

(f) Give **one mark** for $\frac{\textbf{answer to (d)}}{\textbf{answer to (e)}}$

and **one mark** for
an answer correct to 3 significant figures using the numerical values in the expression in **(f)**
(Do not penalise use of moles of $HaHCO_3$ carried in calculator memory from* (e)*)
and sign consistent with experimental results (+ sign required for endothermic reactions)
and unit ($J\ mol^{-1}$ or kJ^{-1})
***Do not penalise if missing mol^{-1} is only error and already penalised in* (c)**
The second mark can be given providing the answer to **(d)** has been divided by a value for moles of Na_2CO_3 or moles of HC*l*. (2)

(g) Give **one mark** for use of ΔH_1 and $2\Delta H_2$.

Give **one mark** for $\Delta H_1 - 2\Delta H_2$ <u>in the final part of the calculation</u>

Watch out for sign errors if the candidate has not stated $\Delta H_1 - 2\Delta H_2$ (2)

ASSESSMENT OF PLANNING SKILLS

Look for the following points in nay part of the plan or carrying out of the plan and award **one mark** for each point

(i) Weights a sample, adds to known volume of water and measures change in temperature.

(ii) Calculates energy change for volume of solution used

(iii) Converts mass $NaHCO_3$ into moles.

Numerical answers are required in parts **(ii)** *to* **(iv)**.

(iv) Calculates ΔH_4 including sign *(unless already penalised).*

(v) Adds 2 ΔH_4 to the answer to **(g)**.
Ignore any reference to ΔH_5 and ΔH_6 etc. by the candidate

Total for Question 1: 25

Question 2

ASSESSMENT OF PLANNING SKILLS

GRID 1A

Adds HC*l*/H_2SO_4 or any soluble chloride or soluble sulphate (or KI) to all three solutions	✓	No precipitate formed with **FB 5** and with **FB 6** (No change or no reaction acceptable)	✓
		White precipitate (yellow with KI) forms with **FB 7** Indicated the presence of Pb^{2+}	✓
(Aqueous) ammonia added to the **two solutions** where no precipitate formed with the first reagent (**FB 5** and **FB 6**) *This mark is lost if 2nd reagent is added to all three solutions*	✓	**FB 5** gives a white precipitate soluble in excess ammonia Indicates the presence of Zn^{2+} **FB 6** gives a white precipitate insoluble in excess ammonia Indicates the presence of Al^{3+}	✓

5

GRID 1B

Adds aqueous ammonia to all three solutions	✓	White precipitate formed with all three solutions	✓
		White precipitate formed in **FB 5** dissolves in excess ammonia solution. Indicates the presence of Zn^{2+}	✓
Adds HC*l*/H_2SO_4 or any soluble chloride or soluble sulphate (or KI) to the two solutions where the precipitate formed with aqueous ammonia did not dissolve in excess of the reagent. *This mark is lost if 2nd reagent is added to all three solutions*	✓	**FB 7** gives a white precipitate (yellow with KI) Indicates the presence of Pb^{2+} There is no precipitate/no change/no reaction with **FB 6** Indicates the presence of Al^{3+}	✓

(5)

GRID 2A

Adds Na_2CO_3 or $NaHCO_3$ to all three solutions	✓	White precipitates formed with all three solutions	✓
		Effervescence or CO_2 or gas turning lime water milky with **FB 6** Indicates the presence of Al^{3+}	✓
(Aqueous) ammonia added to the **two solutions** where no effervescence was seen with the first reagent (**FB 5** and **FB 7**) *This mark is lost if 2nd reagent is added to all three solutions*	✓	**FB 5** gives a white precipitate soluble in excess ammonia Indicates the presence of Zn^{2+} **FB 7** gives a white precipitate insoluble in excess ammonia Indicates the presence of Pb^{2+}	✓

GRID 2B

Adds Na_2CO_3 or $NaHCO_3$ to all three solutions	✓	White precipitates formed with all three solutions	✓
		Effervescence or CO_2 or gas turning lime water milky with **FB 6** Indicates the presence of Al^{3+}	✓
Adds HCl/H_2SO_4 or any soluble Chloride or soluble sulphate (or KI) to the two solutions where no effervescence was seen with the first reagent (**FB 5** and **FB 7**) *This mark is lost if 2nd reagent is added to all three solutions*	✓	**FB 7** gives a white precipitate (yellow with KI) indicates the presence of Pb^{2+} There is no precipitate/no change/no reaction with **FB 5** Indicates the presence of Zn^{2+}	✓

(5)

GRID 3A

Adds HCl/H_2SO_4 or any soluble chloride or soluble sulphate (or KI) to all three solutions	✓	No precipitate formed with **FB 5** and with **FB 6** (No change or no reaction acceptable)	✓
		White precipitate (yellow with KI) forms with **FB 7** Indicates the presence of Pb^{2+}	✓
Adds Na_2CO_3 to the **two solutions** where no precipitate was seen with the first reagent (**FB 5** and **FB 6**) *This mark is lost if 2nd reagent is added to all three solutions*	✓	**FB 5** gives a white precipitate Indicates the presence of Zn^{2+} **FB 6** gives a (white precipitate and) effervescence, CO_2 or a gas giving white precipitate with lime water. Indicates the presence of Al^{3+}	✓

5)

GRID 3B

Adds aqueous ammonia to all three solutions	✓	White precipitate formed with all three solutions	✓
		White precipitate formed in **FB 5** dissolves in excess ammonia solution. Indicates the presence of Zn^{2+}	✓
Adds Na2CO3 or NaHCO3 to the **two solutions** where the precipitate formed with aqueous ammonia did not dissolve in excess of the reagent (**FB 6** and **FB 7**) *This mark is lost if 2nd reagent is added to all three solutions*	✓	**FB 7** gives a white precipitate Indicates the presence of Pb^{2+} **FB 6** gives a (white precipitate and) effervescence, CO_2 or a gas giving white precipitate with lime water. Indicates the presence of Al^{3+}	✓

(5)

NB:

"Method marks" may be awarded from the plan (page 8) or from the observation table (page 9).
Observation marks are awarded from page 9.
Marks are given for positive experimental identification – not for identification by elimination UNLESS the tests have been fully explained in theory in the Plan on page 8.
Reduce the marks awarded by one for each additional reagent used.

Ignore ions listed in the conclusion.

Total for Question 2: 5

Total for Paper: 30