JUNE 2004

GCE A AND AS LEVEL

MARK SCHEME

MAXIMUM MARK: 30

SYLLABUS/COMPONENT: 9701/05

CHEMISTRY
Practical 2

UNIVERSITY of CAMBRIDGE
International Examinations

1 (a) Weighing Table 1.1

Give **one** mark if all **three** weighings are to at least 2 decimal places and in the correct places in the Table.
Give **one** mark for a recorded mass of **FB 1** between **2.80 g and 3.00 g** (both values inclusive)

With-hold one of these marks:
(i) if there is an error in subtraction which should be correct to number of decimal places shown in the weighing table. (Final zeros may be omitted),
(ii) the (mass of tube + residual solid) is less than the mass of the empty tube,
(iii) there is no mass of weighing bottle plus residual zinc

[2]

(b) Temperature Table

Give **one** mark if all **recorded** thermometer readings are to at least 1 decimal place (the table does not have to be complete).
With-hold this mark if all recorded temperatures end with .0(0) or .5(0)

[1]

Accuracy marks

On the Supervisor's script:

Ring the temperature at 2½ minutes (2 minutes, 1½ minutes etc if no temperature recorded at 2½ minutes)

Ring the **highest temperature achieved** when recorded for the first time.
Ignore any temperature recorded at 3 minutes – even if this is the highest temperature recorded.

Calculate the difference between the two ringed temperatures.

Record, in a ring, this temperature rise, Δt, to the left of the temperature table on page 4.

Candidate scripts

Ring the temperature at 2½ minutes and the **highest temperature achieved** when recorded for the first time in the same way as for the Supervisor.
(Again ignore any temperature recorded at 3 minutes – even if this is the highest temperature recorded.)

Calculate the difference between the two ringed temperatures. Record this temperature rise, Δ**t**, to the left of the temperature table on page 4.

Calculate the difference between the Supervisor's and candidate's value for Δt.

Award accuracy marks as shown on the next page

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The expected temperature rise is about 30 °C. If the Supervisor records a temperature rise that is substantially below this figure award Accuracy marks on the sliding scale shown in the following table:

Mark	Difference to Supervisor / °C	
	Δt about 30 °C	**Δt about 15 °C**
8	up to 1.00	up to 0.50
7	1.00+ to 1.50	0.50+ to 0.75
6	1.50+ to 2.00	0.75+ to 1.0
5	2.00+ to 2.50	1.0+ to 1.25
4	2.50+ to 3.00	1.25+ to 1.50
3	3.00+ to 5.00	1.50+ to 2.50
2	5.00+ to 7.00	2.50+ to 3.50
1	7.00+ to 10.00	3.50+ to 5.00
0	Greater than 10.00	Greater than 5.00

[8]

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1 Graph

(d) Plotting of Points.
It is intended that the Examiner will check the plotting of two temperatures on whole numbers of minutes and one at a ½ minute.

Select and indicate, in the temperature table, the following three temperatures:

i The highest temperature reached, recorded for the first time – the value that has been circled in the temperature table for calculating accuracy marks.

If this initial value falls on a whole number of minutes, select, as the second point to be plotted
ii The first temperature, lower than the highest temperature recorded in the temperature table
If this second temperature also falls on a whole number of minutes, select as the third point to be plotted
iii The next lower temperature that falls on a ½ minute

If this initial value falls on a ½ minute, select, as the second point to be plotted
ii The first temperature, lower than the highest temperature recorded in the temperature table that falls on a whole number of minutes
Select as the third point to be plotted
iii The next lower temperature that also falls on a whole number of minutes

Check the plotting of these three points

Give **one mark** if all three points have been correctly plotted.
The plotted point must be within ¼ small square of the correct position on either axis

If the candidate has not plotted one of the selected points apply similar rules to find the first temperature/plot that can be checked.

*Award **no plotting mark** to a candidate who has plotted no temperatures at ½ minutes.*

*Where a maximum temperature is reached after a considerable time and there is no cooling (remaining temperatures are on a plateau) select the maximum and two appropriate points **before** the maximum is reached (one to be on a ½ minute).*

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Give **one mark** if:
an approximately horizontal line has been drawn before the addition of zinc powder,

and

a line or curve of ***"best fit"***, with mainly negative slope, has been drawn after continuous cooling commences

Candidates do not have to link the graphs between 2½ and 3½ minutes.

Give **one mark** if there has been any attempt to extrapolate the cooling curve to 3 minutes.

[3]

(e) If the extrapolation mark has been given in **(d)** give **one** mark if the candidate reads from the graph the extrapolated temperature at 3 minutes. This should be correct to half a small square on either axis.

[1]

(f) Give **one** mark for $\frac{\textbf{mass of zinc}}{\textbf{65.4}}$

[1]

(g) Give **one mark** for $\frac{\textbf{25}}{\textbf{1000}}$ **x 0.80** or **2.0×10^{-2}**

[1]

(h) Give **one** mark for

25 x 4.3 x **Temperature rise calculated in (e)** *(Ignore any sign)*

Correct units, J or kJ, necessary.
With-hold this mark if J/…….. or kJ/…… is shown at this stage.

[1]

(i) Give **one** mark for

$\frac{\textbf{answer to (h)}}{\textbf{smaller of answer to (f) or (g)}}$ *(Ignore moles, /mol, mol^{-1})*

With-hold this mark if the sign **or** units are incorrect.
Do not penalise incorrect units, already penalised in **(h)** ` **[1]**

Total for Question 1 = [19]

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2

(a) Give **one mark** if the apparatus drawn is suitable for the reaction of lithium with water and the collection of gas. *Do not allow delivery tubes etc to pass through apparatus.*
In assessing apparatus consider "Could it be set up with real apparatus?" "Would it work?"

Give **one further mark** if the apparatus drawn or named in the diagram is suitable for measuring the volume of gas collected.
An unnamed gas syringe or inverted measuring cylinder must show graduations in the diagram to score this mark.
No graduations need be drawn if the apparatus has been correctly labelled.

[2]

(b) Give **one mark** for an answer that involves one of the following:
(i) the removal of the oil before weighing (wiping or dissolving in suitable non-aqueous solvent)
(ii) removing the oxidised outer layer
(iii) cutting the lithium to expose fresh metal to the water

[1]

(c) Give **one mark** for a suitable safety measure **and** reason:
(i) use of tweezers or similar/gloves to handle lithium as reactive with moisture on skin
(ii) keeping a flame away from the apparatus as hydrogen is flammable
(iii) wearing gloves as lithium hydroxide is corrosive / highly alkaline

***In parts* (b) *and* (c) *ignore* non-scoring suggestions**

[1]

(d) Give **one mark** for $\frac{\mathbf{100}}{\mathbf{24000}}$ **mole of hydrogen** **(4.17×10^{-3})**

Give **one mark** for (**mole of hydrogen) x 2** **(8.34×10^{-3})**

Give **one mark** for $\frac{\mathbf{0.0583}}{\mathbf{8.34 \times 10^{-3}}} = \mathbf{6.99599.....}$

The value evaluated depends on rounding and the stage at which rounding took place.

6.94, 6.99, 6.996, 7.0, 7.02 or 7 are likely to be seen.

[3]

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Some candidates may attempt the calculation using $pV = nRT$

or $pV = \frac{m}{M_r}nRT$

Give **one mark** for $\textbf{Moles of Li} = \frac{\textbf{0.0583}}{\textbf{A}_\textbf{r}}$

Give **one mark** for $\textbf{Moles of H}_\textbf{2} = \frac{\textbf{0.0583}}{\textbf{2A}_\textbf{r}}$

Give **one mark** for equating to 100 cm^3 of gas and evaluating the answer:

$$\frac{\textbf{0.0583}}{\textbf{2A}_\textbf{r}} = \frac{\textbf{100}}{\textbf{24000}}$$

Other methods of performing the calculation may be seen and should be fitted into the pattern of the methods above.

Examiners should be confident that the use of the mole ratio, (2Li ≡ 1H_2), has been applied by the candidate both correctly and confidently.
Guard against the sudden appearance of an unjustified 2 in a muddled calculation.

(e) Give **one mark** for variable conditions (temperature or pressure) / 24 dm^3 is approximate V_m

AND

Give **one further mark** for a 'chemical' **or** 'procedural' reason such as:
(i) lithium is covered with a layer of oxide **or** lithium reacts with "air" / moisture in the air after or during weighing / cutting / transfer
(ii) residual oil on the lithium
(iii) insufficient water for all the lithium to react **or** excess lithium
*do **not** give this mark for - "not all of the Li reacts"*
(iv) loss of gas at start before apparatus is sealed
*do **not** give this mark for general loss of gas or leaking apparatus*

[2]

(f) Give **one mark** for stating that a titration would be used **or** evaporation to dryness of LiOH or a salt prepared from LiOH + weighing the solid remaining after evaporation

[1]

(g) Give **one mark** for reference to one of
(i) standard or standard / standardised acid used in the titration
(ii) obtaining concordant titres
(iii) % error in pipette **and** burette is very small (or equivalent)
(iv) the end-point of a titration is sharp / precise (or equivalent)
(v) balances weigh to 3 decimal places (or better)

The answer to **(g)** must be related to the answer in **(f)**.

[1]

Total for Question 2 = [11]
Total for Paper = [30]

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