# CHEM PAPER 3 MARKING SCHEME

## Question 1

**Table 1**

| | 1 | 2 | 3 |
|---|---|---|---|
| Final burette reading($cm^3$) | 24.5 | 24.5 | 24.5 |
| Initial burette reading ($cm^3$) | 0.0 | 0.0 | 0.0 |
| Volume of acid used ($cm^3$) | 24.5 | 24.5 | 24.5 |

**Marking**

- Complete table award; ✓

- Decimal consistency; ✓

- Accuracy ± 0.1;✓

- School value; ✓

Principles of averaging:

Average volume = $\frac{24.5 + 24.5 + 24.5}{3}$ = 24.5; ✓ (½ mark)

= 24.5 $cm^3$; ✓(½ mark)

(a) Moles of sodium hydroxide used

Molarity of solution:

Moles = $\frac{\text{Mass /litre}}{\text{RMM}}$

= $\frac{4}{40}$ = 0.1molar

If 1000 $cm^3$ → 0.1mole

Then 25 $cm^3$ → $\frac{25 \times 0.1}{1000}$ = 0.0025 moles;

(ii) Moles of hydrochloric acid

$NaOH_{(aq)} + HCl_{(aq)} \rightarrow NaCl_{(aq)} + H_2O_{(l)}$

Mole ratio = 1:1;

Thus moles of acid = 0.0025 moles;

(iii) Molarity of acid.

Volume of acid reacting = average titre in (a) e.g. 24.5 $cm^3$

If 24.5 $cm^3$ → 0.0025 moles

Then 1000 $cm^3$ → $\frac{1000 \times 0.0025}{24.5}$ = 0.1020 molar;

i)

| Volume of distilled water in the boiling tube $cm^3$. | Temperature in $^0C$ at which crystals first appear. | Solution of solid C in g/100g of water. |
|---|---|---|
| 4 | **68.0** | **112.50** |
| 6 | **58.0** | **75.00** |
| 8 | **53.0** | **56.25** |
| 10 | **47.0** | **45.0** |
| 12 | **43.0** | **37.50** |

a) Complete the table by calculating the solubility of solid C in g/100g of water. (5mk)

Complete table – 1mk

Trend – 1mk

Accuracy – 1mk

Calculation of solubilities – 2mk

b) i) On the grid provided, plot a graph of solubility of solid C against temperature. (3mks)

**s = scale** **S = ½**

**l = labeling** **L = ½**

**p = plotting** **p = 1**

**l = line/curve** **L= 1**

ii) Using your graph determine the temperature at which 100g of solid C would dissolve in 100 $cm^3$ of water. (1mk)

**$66.5^0C$**

**Question 2**

*You are provided with solid X which is a mixture of two compounds, carry out the tests below, record your observations and inferences in the table shown.*

i) Place a spatulaful of solid X in a boiling tube. Add about 10cm3 of distilled water, shake the mixture well and then filter. Wash the residue by adding distilled water. Preserve both the filtrate and the residue.

| Observation | Inferences |
|---|---|
| **Blue solution formed. White insoluble solid settler at the bottom** | **$Cu^{2+}$ present.** |
| **1mk** | **1mk** |

ii) To about 2 $cm^3$ of the filtrate add 3 – 4 drops of Barium nitrate followed by a few drops of dilute nitric (V) acid solution.

| Observation | Inferences |
|---|---|
| **White ppt formed which remains on addition of $HNO_3$** | **$SO_4^{2-}$ present** |
| **Or insoluble in $HNO_3$** | |
| ((1mk) | (1mk) |

iii) To about 2 $cm^3$ of the filtrate add sodium hydroxide dropwise until in excess.

| Observation | Inferences |
|---|---|
| **Blue ppt formed insoluble in excess** | **$Cu^{2+}$ present** |
| (1mk) | (1mk) |

b. i) Remove the residue from the filter paper and put it in the boiling tube. Add about 6 $cm^3$ of dilute nitric (V) acid until all the solid dissolves

| Observation | Inferences |
|---|---|
| **Effervescence/ bubbling occurs with evolution of** | **$CO_3^{2-}$ present.** |
| **A colourless gas. A colourless solution is formed.** | **$Cu^{2+}$, $Fe^{2+}$ or $Fe^{3+}$ ions absent.** |

(1mk) (1mk)

ii) To about 2 $cm^3$ of the solution formed in (i) above add sodium hydroxide drop wise until in excess.

| Observation | Inferences |
|---|---|
| **White ppt forms insoluble in excess.** (1mk) | **$Zn^{2+}$, $Pb^{2+}$ or $Al^{3+}$ present.** (1 mk) |

iii) To another 2 $cm^3$ portion of the solution formed in (i) above add 4 -5 drops of dilute hydrochloric acid and warm the mixture.

| Observation | Inferences |
|---|---|
| **White ppt formed which dissolves on warming** (1mk) | **$Pb^{2+}$ present** 1 mk) |

**Question 3.**

i)

| TEST I | EXPECTED OBSERVATION |
|---|---|
| **Place an endful spatula of solid M on a clean dry metallic spatula. Burn in a non-luminous part of Bunsen burner flame.** **(½ mk)** | **Burns in a yellow sooty/smoky flame.** **(½ mk)** |

Place the remaining solid M in a boiling tube. Add about 10.0cm3 of distilled water and shake well. Divide the mixture into two portions for test II and II below.

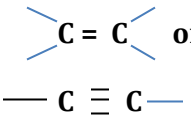
| TEST II | EXPECTED OBSERVATION |
|---|---|
| **To the first portion add 1 $cm^3$ of universal indicator to test the pH of the solution.** **( 1mk)** | **Solution has a pH of 5** **(½ mk)** |

| TEST III | EXPECTED OBSERVATION |
|---|---|
| **To the secondportion, add an endful spatula of solid sodium carbonate.** | **An effervescence is produced of a colourless gas.** **(½ mk)** |

| | |
|---|---|
| **( 1mk)** | |

Carry out the tests described in (a) using solid M and record the observations and inferences in the spaces provided.

Test 1

| Observations | Inferences |
|---|---|
| **A yellow sooty/smoky flame is produced.**<br><br>**The metallic spatula turns to black.**<br><br>(1mk) | **Presence of**  **or**<br><br>**A long unsaturated hydrocarbon is present**<br>(1 mk) |

Test II

| Observations | Inferences |
|---|---|
| **pH = 1**<br><br>1mk) | **Strongly acidic**<br><br>1mk) |

Test III

| Observations | Inferences |
|---|---|
| **An effervescence of a colourless gas produced**<br><br>**or**<br><br>**Bubbles of a colourless gas.**<br><br>(1mk) | **the substance contains H+ or -COOH**<br><br>**or**<br><br>**An organic acid**<br><br>(1 mk) |