**MARKING SCHEME CHEMISTRY PAPER 3**

1. Table 1……………………………………………………………………………………………………………………....5mks

Award a maximum total of 5 marks distributed as follows.

1. Complete table…………………………………………………..…………………………………..……1mk

Conditions: either of the following:

* Complete Table with 3 Titrations done…………………………………………… …… 1mk
* Incomplete Table with only 2 Titrations done………………………………………… ½mk
* Incomplete Table with only 1 Titration done…………………………………..… …..0mrk
* For no Titration done……………………………………………………………………………….0mk

NOTE: where NO TITRATION done, penalize FULLY for ALL the marking points for Table 1.

**Penalties:**

before awarding a mark for complete Table; THE EXAMINER MUST ensure that none of the following mistakes is there in the Table- otherwise penalize ½mk for EACH MISTAKE but to a maximum penalty of ½mk(i.e. penalize ½mk ONCE even if there two or more mistakes):

* Wrong arithmetic/subtraction
* Inverted Table
* Burette reading(s) beyond 50.0cm3, except where explained.
1. Use of Decimals (tied to the 1st and 2nd ROWS ONLY)…………………………….………...1mk

Conditions:

Either 1 or 2 decimal places used consistently.

If 2 decimal places are used then the 2nd decimal place MUST be either a “O”

1. Accuracy (tied to CORRECT titre values ONLY)……………………………………..………1mk

Compare the candidate’s CORRECT Titre values with the school values, (i.e. Teacher’s Average Titre):

Conditions:

* If at least one titre value is within $\pm $0.10 cm3 of SV, then awarded……………………1mk
* If No titre value is within $\pm $0.10 cm3 of the SV but at least one titre value is within$\pm $0.20 cm3 of the SV, then award ½mark
* If NONE of the titre values is within $\pm $0.20 cm3 of the SV, then award………………0mark

NOTE: If there is wrong arithmetic/ subtraction in the Table, compare the SV with the CORRECT worked out titre and award accordingly.

1. Principles of averaging…………………………………………………………………………………………..1mk

Values averaged MUST be shown and MUST be consistent within$\pm $0.20 cm3 of each other.

**Conditions.**

* If 3 consistent values are averaged…………………………………………………….……………...1mk
* If 3 titrations are done and only 2 possible averaged………………..………………………..1mk
* If only 2 titrations are done, and are inconsistent and averaged…………………………….1mk
* If only 2Titrations are done, and are inconsistent and yet averaged…………………………0mk
* If 3 Titrations are done, ALL are possible and yet only 2 are averaged……………………….0mk
* If 3 inconsistent values are averaged………………………………………………………………0mk
* If only 1 Titration is done………………………………………………………………………………..0mk

**Penalties:**

* Wrong arithmetic, i.e. arithmetic error outside $\pm $2 units in the 2nd decimal place (e.g. 24.67 given as 24.64), penalize ½mk
* If no WORKING is shown but “answer” given is correct, penalize ½mk.
* If value is rounded off to the1st decimal place (e.g. 24.66$≈$ 24.7) or to a whole – number (e.g.24.33$≈$24), penalize ½mk.
* If no working is shown but answer given is wrong, penalize FULLY, i.e. award 0mk
1. Final accuracy (tied to the CORRECT average titre)……………………………..…………….1mk
* Compare the candidate’s CORRECT average titre with the SV and award accordingly:
* If within $\pm $0.10 cm3 of the SV, award……………………………………………..………………..1mk
* If Not within$\pm $0.10 cm3 of the SV, but it is within $\pm $0.20 cm3 of the SV, award ………..½mk
* If BEYOND $\pm $0.20 cm3 of the SV, award…………………………………………………………….0mk

Complete table…………………….1mk

**TABLE 1**

Use of decimals……………………1mk

Accuracy …………………………..1mk

Principles of averaging……………1mk

Final accuracy…………………….1mk

**Sub-total**  5mks

Calculations :

**(i)** Moles of NaOH in average titre = $\frac{0.05 ×30.0}{1000}√½mk$

$$=0.0015 mol √½mk$$

 **Note:**

* Units may not be given but if given Must be correct otherwise penalize½mark foe wrong units attached to correct answer.

**(ii).** Moles of HCl in 25 cm3 of solution FA4

 NaOH : HCl

 1 : 1$ √1mk$

$0.0015 mol $ $0.0015 mol √1mk$

**(iii)** =$\frac{0.0015 ×250}{25}√1mk$ $=0.015 mol √1mk$

 **Note:**

* 0.0015 MUST be transferred and used INTACT otherwise penalize FULLY for any other figure used and award 0mk
* Accept answer given to at least 4 decimals places, otherwise penalize $½mk$ for rounding off to 3 decimal places or less.

 **(iv)**

* Moles of HCl in 50 cm3 of FA2 =$\frac{0.7 ×50}{1000}√½mk$

 = 0.035 $√½mk$

 **(v)** moles of HCl that reacted with magnesium= Ans in (v) – ans in (iv)

 0.035- 0.015$√½mk$ = 0.02$√½mk$

**(vi)** Mg : HCl

 1 : 2$√½mk$

=$\frac{0.02 ×1}{2}√½mk$ $=0.01 mol √1mk$

1. Table 2………………………………………………………………………………………………..4mks

Award a MAXIMUM TOTAL of 4mks distributed as follows:

i) Complete table………………………………………………………………………………..2mks

Conditions/ penalties

* Award $½mk$ for EACH experiment completely done.
* Penalize $½mk$ for EACH solubility value either wrongly worked out or not work to a MAXIMUM penalty of 1mark.
* Penalize 1mark ONCE for unrealistic Temperature readings, for any Temperature reading T$\leq 25.0℃ and T>80.0℃$.
* Penalize$½mk$ if ALL Temperature readings given in the Table are CONSTANT.

ii) Use of decimals(Tied to Temperature reading)………………………………………………..$ ½mk$

Accept ONLY if all readings recorded consistently either as whole numbers or to one decimal place of .0 or .5, otherwise penalize FULLY.

iii) Accuracy ………………………………………………………………………………………$½mk$

Compare the candidate’s first Temperature reading (i.e. Temperature reading when the volume of water added is 5.00cm3) with the school value, SV (i.e. the Teacher’s temperature reading when the volume of water added is5.00cm3). If within $\pm 2.0℃$ of the SV, awarded 1mark, otherwise awarded 0mark.

iv) Trend ………………………………………………………………………………..1mk

Award mark for Temperature readings showing a CONTINUOUS DROP, otherwise penalize FULLY.

Hence the distribution of marks for table 2 is as follows.

Complete table………………….2mks

**TABLE 2**

Use of decimals…………………$½mk$

Accuracy ………………………….$½mk$

Trend …………………………….…1mk

**Sub-total** 4mks

f) GRAPH……………………………………………………………………………….3mks

Award MAXIMUM total of 3marks distributed as follows

1. Labeling of the axes…………………………………………………………………$½mk$.

Award$ ½mk$ ONLY if BOTH axes are CURRECTLY labelled.

**Penalties:**

* Penalize FULLY for inversion of axes
* Penalize FULLY for wrong unit given, otherwise ignore if units are omitted.
* Penalize FULLY if only ONE axis is correctly labelled.
1. **Scale** ………………………………………………………………………………….$½mk$

Award $½mk$ for scale subject to the following conditions.

**Conditions:**

* Area covered by the PLOTS must be at least half the grid on EACH of the axis
* Scale intervals MUST be consistent on EACH axis.
* Scale chosen must be able to accommodate ALL plots/ points-Examiner MUST check the range of the readings on EACH axis.

**Note:** panelize FULLY if any of the above three conclusions is NOT met.

1. Plotting ………………………………………………………………………………...1mk

Award maximum of 1 mark for plotting.

**Conditions:**

* if 6 or 5 points are correctly plotted award ………….1mk
* if only 4 or 3 points are correctly plotted award $½mk$
* If less than 3 points are correctly plotted award……….0 mark.
1. Curve …………………………………………………………………………………1mk

Award 1mark for a smooth rising curve joining at least three correctly plotted points.

**Note:** Reject curve obtained by plotting 2 or more wrongly calculated solubility values from table 2.

Hence the distribution of marks for the graph is as follows.

Label of axes..…………………….$ ½mk$

GRAPH

Scale………………………………...…$½mk$

Plotting………………………………..1mk

Curve …………..………………………1mk

Sub-total 3mks

 (g)

 (I) Correct reading from the graph.$ √1mk$

 (II) Correct reading from the graph.$ √1mk$

(h) 100g – ans in (g)(ii) $ √1mk$

 Final ans$ √1mk$

1. **a**

|  |  |
| --- | --- |
| **OBSERVATION(S)** | **INFERENCE(S)** |
| * White ppt $√½mk$ formed which then dissolves $√½mk$ in excess alkali forming a colourless solution.
 | Al2+, Pb2+, Zn2+,present$√1mk$ * All 3 ions given
* Only two ions given.$½mk$
* Only one ion given. 0mk
 |

|  |  |
| --- | --- |
| **OBSERVATION(S)** | **INFERENCE(S)** |
| * White ppt$√½mk$ formed which is insoluble $√½mk$ in excess aqueous ammonia
 | Al2+$√½mk$ , Pb2+,$√½mk$ present* Penalize ½ mark for each contradictory ion.

  |

|  |  |
| --- | --- |
| **OBSERVATION(S)** | **INFERENCE(S)** |
|  |  |
| * White ppt formed $√1mk$

$$Type equation here.$$ | Pb2+ present$.√1mk$ |

|  |  |
| --- | --- |
| **OBSERVATION(S)** | **INFERENCE(S)** |
| * Yellow White precipitates formed $√1mk$
 | Pb2+ present$.√1mk$* Penalize FULLY for any contradictory ion.

 (1mks) |

B. (i)

|  |  |
| --- | --- |
| **OBSERVATION(S)** | **INFERENCE(S)** |
| * Solution has pH=2 $√1mk$ .
* NOTE. Reject pH given as range.
 | Solution is strongly acidic. $√1mk $ * NOTE. Reject the solution is “strong acid”.
* Correct inference tied to correct pH.
 |

(ii)

|  |  |
| --- | --- |
| **OBSERVATION(S)** | **INFERENCE(S)** |
| * KMnO4 solution is decolourised$√1mk $

OR* KMnO4 solution changes from purple to colourless.$√1mk $
* NOTE. Reject “ solution becomes/ turns colourless” or “ it turns colourless”
 | R-OH and $>C=C</-C≡C-$ present $√1mk $    |

(iii)

|  |  |
| --- | --- |
| **OBSERVATION(S)** | **INFERENCE(S)** |
| * Effervescence producing a clourless gas $√1mk $
 | R-COOH present $√1mk $   |