**CHEMISTRY PAPER 3 MARKING SCHEME**

**DECEMBER EXAM 2021**

**FORM FOUR**

**QUESTION 1(22Marks)**

1. Table 1 (6marks)

|  |  |  |
| --- | --- | --- |
| Volume of water in the boiling tube (cm3) | Temperature at which crystals of solid A first appear | Solubility of solid A (g/100g water ) |
| 4 | 66.0 | 112.5 |
| 6 | 58.0 | 75 |
| 8 | 52.0 | 56.25 |
| 10 | 45.0 | 45 |

**Column 1** 4 marks

 Distributed as follows:

(i) Complete table 2 marks

 - Complete table with 4 readings 2 marks

 - Incomplete table with 3 readings 1 ½ marks

 - Incomplete table with 2 readings 1 mark

 - Incomplete table with 1 reading 0 mark

(ii) Use of decimals 1 mark

 - Accept unit if all readings are recorded consistently either as whole numbers or to

1 d. place of 0.0 or 0.5, otherwise penalize fully.

(iii) Trend ½ mark

- Award ½ mark for a continuous drop in temperature readings in column I, otherwise penalize fully.

Column II 2 marks ( 4 x ½ mks)

- Award ½ mark for each value of solubility correctly calculated, otherwise penalize fully.

- Ignore units in grams if attached to correct answer, otherwise penalize if wrong units are attached.

 **Graph** 3 marks

 Distributed as follows:-

(**i) Labelling of axes ½ mark**

 - Penallise fully for any inversion of axis.

 -Penallise fully if wrong units are given or shown BUT ignore if not attached.

 - Penalise fully if only one axis is labeled.

 **(ii) Scale ½ mark**

- Area covered in units should be at least ¾ of the total big square of the grid, given on both vertical and horizontal axis, otherwise penalize fully.

- Scale intervals must be consistent, otherwise penalize fully.

- Scale chosen must accommodate all plots, otherwise penalize fully.

**(iii) Plotting 1 mark**

 - Award 1mark for 3 or 4 points correctly plotted.

 - If there are only 2 correctly plotted points, award ½ mark.

 - Accept plots even when axis is interchanged.

**(iv) Curve 1 mark**

- Award 1 mark for a smooth rising curve joining at least 3 correctly plotted points of which one must be at 112.5 / 4.0cm3 of water.

- Reject a curve obtained from wrong calculated values in column II.

(iii) **I**  1 mark

- Accept correct reading with or without showing on the graph.

- If shown on the graph but reading is wrongly read, or absent award ½ mark for showing.

- Penallise ½ mark for wrong units otherwise ignore if not shown.

- Reject any reading and showing from a wrong graph e.g exchange of axis, wrong plotting at volume of 4.0cm3.

 **II** 2 marks

 Solubility at 550C = correct reading √ ½

 Solubility at 450C = correct reading

 Mass of crystals = difference in solubilities √ ½

(e) (i) Table 2 5 marks

|  |  |  |  |
| --- | --- | --- | --- |
|  | I | II | III |
| Final burette reading | 30.0 | 30.0 | 30.0 |
| Initial burette reading | 0.0 | 0.0 | 0.0 |
| Volume of solution B used | 30.0 | 30.0 | 30.0 |

 Distributed as follows:-

**(a) Complete table 1 mark**

 Conditions

 (i) Complete table with 3 titrations 1 mark

 (ii) Incomplete table with 2 titrations ½ mark

 (iii) Incomplete table with 1 titration 0 mark

**Penalties**

 - Wrong arithmetic

 - Inverted tables.

 - Values beyond 50.0cm3 unless explained

 - Unrealistic values i.e values below 1.0cm3 and above hundreds

NB: Penalize ½ mark each to a maximum of ½ mark (penalize once)

(b) Decimals 1 mark (Tied to 1st and 2nd rows only)

 Conditions

 - Accept 1 or 2 dp used consistently

 - Accept 2 d.p only if the 2nd place of decimal is “0” or “5”.

 - Allow inconsistency of zeros i.e 0.0, 0.00 or 0 in the initial values

NB: Penalize fully if any of the conditions is not met.

**c) Accuracy 1 mark**

 Compare any of the titre readings with school values (S.V) tick (√) the chosen value on the table.

Condition

 - If any value is within ± 0.1 1 mark

 - If any value is within ± 0.2 ½ mark

 - If not within ± 0.2 0 mark

NB: If there is a wrong arithmetic or subtraction compare the S.V with the worked out correct value and award accordingly.

d) Principles of averaging 1 mark

 Values averaged MUST be shown and must be within ± 0.2 of each other.

Conditions

 - If 3 consistent values are averaged 1 mark

 - If 3 titrations alone, only 2 possible and averaged 1 mark

 - If 2 titrations alone, and are consistent and averaged 1 mark

NB: Award 0 mark if averaging involves.

 - 3 consistent values but only 2 averaged

 - 3 inconsistent values are averaged.

 - 2 inconsistent values are averaged.

e) Final answer 1 mark (Tied to correctly averaged titre )

 - If within ± 0.1 S.V 1 mark

 - If within ± 0.2 S.V ½ mark

 - If beyond ± 0.2 of S.V 0 marks

***Calculations***

II) Moles of KMnO4 = 0.06 x titre √ ½

 1000

 = correct answer √ ½

Conditions

1. Penalize ½ mark for wrong transfer of titre, otherwise penalize fully for strange figure.
2. 0.06 must be transferred intact otherwise penalize fully.

III) Moles of A in 25.0cm3 = Ans in (II) x 5 √ ½

 2

 = correct ans √ ½

IV) RFM of A 2 marks

 Moles in 250cm3 = an in III x 250 √ ½

 25

 = correct ans

 RFM = 4.5 √1

 Ans above

 = Correct answer √ ½

OR

 Mass in 25cm3 = 0.45g √ ½

 RFM = 0.45 √1

 Moles in part III

 = Correct answer √ ½

OR

 Mass in 1000cm3 = 4.5 x 4 = 18g

 Molarity of A = 1000 x ans III √ ½

 25

 RFM = 18

 Molarity √1

 = correct ans √ ½

Penalties

1. Penalize fully if 4.5 is not used intact
2. Reject if RFM is less than 108 and greater than 162.
3. Penalize ½ mark for any units used or attached to the final answer e.g g

(V) Determining the value of X 2 marks

 2 + 24 + 64 + x (2+16) = ans (IV) √ ½

 18x = ans (IV) – 90

 x = ans (IV) – 90 √ 1mk

 18

 = correct answer √ ½

OR 90 +18x √ ½ = ans (IV)

 x = ans (IV) – 90 √1

 18

 = correct ans √ ½

OR

 x = ans (IV) – 90 1mk

 18

 = correct ans 1mk

Penalties

- Penalize ½ mark if units given or attached to final answer.

NB: For all calculations, any working beyond the expected answer penalize fully.

**QUESTION TWO (12 MARKS)**

|  |  |
| --- | --- |
| **observations** | **inferences** |
| a(i) yellow residue when hotWhite on cooling ½ mkBurning splint extinguished ½ mk | Zn2+present ½ mkCO32- present ½ mk |
| (ii)Bubbles of colourless gas | CO32- present |
| (iii)white ppt soluble in excess | Zn2+present |
| b(i)white ppt soluble in excess | Zn2+present |
| (ii) No effervescence  | CO32- SO32- absent |
| (iii) white ppt | SO42- |

**QUESTION THREE (06 MARKS)**

|  |  |
| --- | --- |
| observation | inference |
| (a) Burns with a blue flame | Saturated organic compound//low carbon to hydrogen ratio// double, triple bond absent |
| (b) No efferevescence //no fizzing | RCOOH absent |
| (c) Orange potassium dichromate(VI) turns green | R-OH present |