**SUNRISE 2 EXAMANITION - 2022**

***Kenya Certificate of secondary Education***

***(K.C.S.E)***

***CHEMISTRY PAPER 3 MARKING SCHEME***

*Table 1*

|  |  |  |
| --- | --- | --- |
| *Volume of distilled water*  | *Crystallization temperature 0C* | *Solubility of solid P in g/100g of water* **CT-5****D-1****A-1/2** **T-1/2**  |
| 4 | 65 | 100 |
| 6 | 55 | 66.7 |
| 8 | 48 | 50.0 |
| 10 | 43 | 40 |
| 12 | 38 | 33.3  |

1. Complete table ……. 5 marks
2. award 1/2 mk for each entry of temperature and correct calculation of solubility. Total (5mks)
3. Decimal….. 1mk
* Award 1/2 mk for temperature expressed as whole numbers or to 1 decimal place consistently.
* Award 1/2 mk for solubility expressed to 1dp unless it works out to a whole no.
1. Accuracy ….. 1/2mk
* Compare candidates first temperature reading with that of the teacher. Award ½ mk

if its within +-20C

1. Trend ……1/2 mk
* Award ½ mk if temperature readings show gradual decrease.
1. On the grid provided, plot a graph of solubility of solid $P(y-axis$) against crystallization temperature. (3 marks)



**Crystallization temperature 0C**

**S-1/2**

 **L-½**

**P – 1**

**C - 1**

**Solubility of P**

* *scale – ½ should cover at least half of the no. of squares*
* *Labelling ½mk both axes should be correctly labelled*
* *Plotting 1mk all points plotted correctly*
* *Line 1mk smooth curve*
1. From the graph determine;
2. The solubility of solid P at 600C. (1 mark)

$780g/100g of H\_{2}O$ 1mk

* *1mk for correct reading*
* *½ mk for showing if reading is not correct*
1. The temperature at which 40g of P dissolves in 50g of water. (1 mark)

$\frac{100×40}{50}=80g/100g ofH\_{2}O$ ½ mk

 = 560C ½ mk

* *½ mk for correct reading*
1. The mass of P that crystallizes out when the mixture is cooled from 550C to 450C. (1 mark)

**½ mk**

**½ mk**

$ 65-41 =24g$

½ mk for reading

½ mk correct answer

Table II teachers value + -0.1

***CT -1***

***D -1***

***A -1***

***PA -1***

***FA -1***

 ***5***

**Final burette reading (cm3)**

**16.8 33.7 17.0**

 **I II III**

**0.0 16.8 0.0**

**Initial burette reading (cm3)**

**16.8 16.9 17.0**

**Volume of solution Q used in (cm3)**

(4 marks)

  *NOTE*

 *Complete table decimal, accuracy and final accuracy are marked as in table 1*

Calculate; values averaged must be within +-0.2 of

1. Average volume of Q used. each other

**½ mk**

$\frac{16.8+16.9+17.0}{3}= 16.9$

**½ mk**

1. i) Moles of solution X used.

 **½ mk**

$\frac{25×0.2}{1000}$ =0.005

**½ mk**

**½ mk**

ii) Moles of solution Q used. $\frac{Answer in b (i)}{2}=correct answer$

**½ mk**

**½ mk**

 $\frac{0.005×1}{2}=0.0025$

**½ mk**

iii) Concentration of solution Q in moles per litre. $\frac{250×answer in b (ii)}{titre value }=correct answer$

**½ mk**

**½ mk**

 $\frac{250×0.0025}{16.9}=0.03698$

**½ mk**

**½ mk**

**½ mk**

**½ mk**

 $\frac{1000×0.03698}{250}=0.14792$ $\frac{1000 ×answer in b \left(iii\right)}{250}=corr.asn$

1. Determine the value of n in the formula H2C2O4. nH2O

(H=1.0, C=12.0, O=16.0)

 Concentration in g/l

$\frac{1000×4}{250}=16g/l$

**½ mk**

Molar mass = $\frac{16×1}{0.14792}108.17$ $\frac{ans in c}{ans in b (iii)}$

$H\_{2}C\_{2}O\_{4}.nH\_{2}O$

**½ mk**

$$2×2×12×4×16×18n=108.17$$

$$18n=10^{8}.17-90$$

$18n=18.7$

**½ mk**

$n=1$ NOTE: Penalise ½ mk if n>1

2. You are provided with solid R. Carry out the following tests and record the observations and inferences in the spaces provided.

(a) Place about one-third of solid R in dry test-tube. Heat the solid strongly and test any gas

 with both blue and red litmus papers.

|  |  |
| --- | --- |
|  *Observations* | *Inferences* |
| * Colourless liquid on the cooler parts of the test tube

**½ mk****½ mk*** Red litmus turns blue

**½ mk*** Blue litmus paper remains blue
 | It’s a hydrated salt /contains water of cystallisation (*tied to colourless liquid on cooler parts of the test tube*) **½ mk****½ mk**NH4+ present (tied to red litmus turns blue)  |

 (b) Place the remaining amount of solid R in a boiling tube. Add about 15cm3 of distilled

 water and shake. Divide the mixture into four test tubes each containing about 2cm3.

1. To the first portion, add four drops of dilute hydrochloric acid.

|  |  |
| --- | --- |
|  *Observations***½ mk** | *Inferences***½ mk** |
| No effervescence / no bubbles **½ mk**No white PPt **½ mk** | CO32- , SO32- absent Pb 2+ Ag+ absent (*each ion* ½ mk) |

1. To the second portion, add two or three drops of aqueous barium nitrate.

|  |  |
| --- | --- |
|  *Observations***½ mk** | *Inferences* |
| White PPt  | SO42- present **½ mk** |

1. To the third portion, add aqueous sodium hydroxide dropwise until in excess.

|  |  |
| --- | --- |
|  *Observations* | *Inferences* |
| White PPt **½ mk****½ mk**Soluble in excess  | Zn2+, Al 3+ present **½ mk *each*** |

1. To the fourth portion, add aqueous ammonia dropwise until in excess.

|  |  |
| --- | --- |
|  *Observations* | *Inferences* |
| White PPt ½ mkInsoluble in excess ½ mk | Al 3+ present**½ mk** |

3. You are provided with solid S. carry out the following tests and record the observations and

inferences in the spaces provided.

(a) Place about one-third of solid S on a clean metallic spatula and burn it in a Bunsen burner flame.

|  |  |
| --- | --- |
|  *Observations* | *Inferences* |
| It burns with a yellow/sooty/smocky flame 1mk |  $ C=C C≡C-$ (1mk)Present or unsaturated organic compound 1mk |

(b) Place the remaining amount of solid S in a boiling tube. Add about 10cm3 of distilled water and shake. Use the mixture for tests (i) and (iii) below.

|  |  |
| --- | --- |
|  *Observations* | *Inferences* |
| Dissolves to form a colourless solution ½ mk | Polar organic compound Accept polar compound 1/2 mk |

 (i) Using about 2cm3 of the mixture in a test-tube, determine the PH using universal indicator paper and chart.

|  |  |
| --- | --- |
|  *Observations* | *Inferences* |
| **½ mk**PH= 1Accept PH=2, or 3 Reject PH given as a range  | Strongly acid ½ mkIgnore acidic H+/H3O+Reject strong acid  |

(ii) To about 2cm3 of the mixture in a test-tube, add two or three drops of acidified potassium manganate (VII).

|  |  |
| --- | --- |
|  *Observations* | *Inferences* |
|  Acidified potassinon manganate (VII) is decolourized/ turns from purple to colourless  |  $ C=C C≡C-$ (1mk)**½ mk**R-OH present  |

 (iii) To about 2cm3 of the mixture in a test-tube add two drops of acidified potassium dichromate (VI).

|  |  |
| --- | --- |
|  *Observations* | *Inferences* |
| Acidified potassium dichromate (VI) turns from orange to green 1mk | R- OH present 1mk |