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 FORM 4 ENTRANCE EXAMS 2023

**233/3**

**CHEMISTRY PRACTICAL**

**MARKING SCHEME**

**Kenya Certificate of Secondary Education**

**Table I**

***CT=1***

***Dec = 1***

***Acc = 1***

***PA = 1***

***FA = 1***

***5 Marks***

|  |  |  |  |
| --- | --- | --- | --- |
|  | I | II | III |
| Final burette reading | ***23.9*** | ***24.0*** | ***24.1*** |
| Initial burette reading | ***0.0*** | ***0.0*** | ***0.0*** |
| Volume of solution **Q** used (cm3) | ***23.9*** | ***24.0*** | ***24.1*** |

1. What is the average volume of solution **Q** used?

$$\frac{23.9+24.0+24.1}{3}=24.0cm^{3}$$

1. Determine the:
2. Concentration of solution **Q** in moles per litre. (Na = 23.0; O = 16.0, H = 1.0) (1mark)

$$\frac{8.8}{40}=0.22M$$

1. Concentration of solution **P** in mole per litre (2marks)

$$\frac{M\_{1}V\_{1}}{M\_{2}V\_{2}}=\frac{1}{1}$$

$$\frac{M\_{1}×25}{0.22×24}=\frac{1}{1}$$

$$M\_{1}=\frac{0.22×24}{25}$$

$= 0.2112M$

**Table II**

***CT=1***

***Dec = 1***

***Acc = 1***

***PA = 1***

***FA = 1***

***5 Marks***

|  |  |  |  |
| --- | --- | --- | --- |
|  | I | II | III |
| Final burette reading | ***12.4*** | ***12.5*** | ***12.6*** |
| Initial burette reading | ***0.0*** | ***0.0*** | ***0.0*** |
| Volume of solution **Q** (cm3) | ***12.4*** | ***12.5*** | ***12.6*** |

1. What is the average volume of solution **Q** used?

$$\frac{12.4+12.5+12.6}{3}=12.5cm^{3}$$

1. Calculate the :
2. Moles of hydrochloric acid in 25.0cm3 of solution **K**. (1mark)

$$Moles of HCl in 25cm^{3}of A=moles of NaOH in 12.5cm^{3} of J$$

$$\frac{0.22×12.5}{1000}$$

$$=0.00275moles$$

1. Moles of hydrochloric acid in 100cm3 of solution **K**. (1mark)

$$\frac{0.00275×100}{25}$$

$$=0.011moles$$

1. Moles of hydrochloric acid in 100cm3 of the original hydrochloric acid solution **P**. (1mark)

$$\frac{0.2112×100}{1000}$$

$$=0.02112moles$$

1. Moles of hydrochloric acid that were used up in the reaction with solid **B**. (1mark)

$Ans a\left(iii\right)-a\left(ii\right)$

$$=0.02112-0.011$$

$$=0.01012moles$$

1. Moles of the carbonate that reacted with hydrochloric acid. (1mark)

 **CO32-(aq) + 2H+(aq) CO2(g) + H2O(l)**

$$\frac{0.01012×1}{2}=0.00506moles$$

1. Given that the relative formula mass of the carbonate is 72, calculate the:
2. Mass of the carbonate that reacted. (1mark)

$$\frac{0.00506×72}{1}=0.36432g$$

1. Percentage purity of the carbonate, solid **B**. (1mark)

$$Percentage purity=\frac{0.36432}{0.6}×100$$

1. **(10marks)**
2. Place **all** of solid **M** in a boiling tube and add about 10cm3 distilled water and shake.

**Observations Inferences**

* ***Colourless solution (½mk)***
* ***Cu2+, Fe2+, Fe3+ absent (½mk)***

1. Divide the solution into five portions of about 2cm3 each.
2. To the first portion, add aqueous sodium hydroxide dropwise until in excess.

**Observations Inferences**

***Ca2+, Mg2+, Ba2+present***

***- All three/any two correct ions given 1 mk.***

***- Only one correct ion given ½ mk.***

* ***White ppt (½mk) insoluble in excess½mk***

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

**Observations Inferences**

***Mg2+, Ba2+present***

***- All two correct ions given 1 mk.***

***- Only one correct ion given ½ mk.***

* ***White ppt (½mk) insoluble in excess½mk***

1. Dip a glass rod in the third portion and heat it on a burnsen burner flame, identify the colour of the flame produced.

**Observations Inferences**

***Ba2+present (½mk)***

* ***Green flame (½mk)***
1. To the fouth portion,add about 1cm3 of lead (II) nitrate solution.

**Observations Inferences**

***SO42-, CO32-, SO32-absent***

***- All 3 ions given 2mks***

***- 2 ions given 1mk***

***- 1 ion given ½ mk***

***NOTE:***

***- Where there is a contradictory ion mark out of 1½ mks and penalise ½ mk for EACH contradictory ion given to a maximum of 1½ mks.***

***- Accept correct ion(s) written in words for ½mk***

* ***No white ppt 1mk***

***NOTE***

***- Accept “No ppt”/”colourless solution retained”/ “No observable change” for½mk but accept CORRECT inference and credit accordingly***

 ***- REJECT Colourless solution formed/No colour change/ No white substance/ No reaction/ No observation***

1. To the fifth portion, add about 1cm3 of dilute sodium hydroxide followed by a small piece of aluminium foil. Warm the mixture gently and carefully. Test any gas produced using blue and red litmus papers.

**Observations Inferences**

***NO3- present (1mk)***

***Colourless gas (½mk) the turns red litmus blue and blue litmus remains blue (½mk)***

1. **(10marks)**
2. Place about one third of solid **W** on a **metallic** spatula and burn it using a Bunsen burner.

**Observations Inferences**

* ***Solid melts and burns with a yellow(½mk)/ luminous and sooty(½mk)/ smoky flame***

***C = C / ̶ C ≡ C ̶ present (1mk)***

***NOTE***

***Accept either of the following given in words in place of the above structures for FULL credit.***

* ***Carbon to carbon double/ triple bond present /Unsaturated organic compound /Long chain organic compound /Aromatic compound /Organic compound with high Carbon-hydrogen ratio. (Reject C = C / C ≡ C)***

***Ignore***

* ***Alkene / Alkyne present/Long chain hydrocarbon present.***

***Penalize FULLY for any contradicting functional group given.***

1. Place the remaining solid **W** into a boiling tube. Add 10cm3 of distilled water and shake well. Use 2cm3 portions of the mixture for each of the following reactions.
2. To the first portion, add 2 drops of acidified potassium manganate (VII) and shake well.

**Observations Inferences**

***C = C / ̶ C ≡ C ̶ (½mk), R – OH (½mk) present***

***NOTE***

***In absence of the above structures, accept the CORRECT inference given in words for FULL credit as “unsaturated organic compound and alcohol / alkanol present”.***

* ***Acidified potassium manganate (VII) solution is decolourised OR Purple colour of acidified potassium manganate (VII) changes to colourless OR purple colour of acidified KMnO4 solution turns colourless.***
1. To the second portion, add three drops of bromine water

**Observations Inferences**

***C = C / ̶ C ≡ C ̶ present***

* ***Yellow/ orange bromine is decolourised. (1mk)***

1. To the third portion put universal indicator paper.

**Observations Inferences**

* ***Weakly acidic (1mk)***

***Reject***

***Weak acid/weak alone***

* ***pH=4 (1mk)***
* ***Accept pH = 5 or 6***

***Reject pH given as a range***

1. To the fourth portion add a little solid **Y**, sodium hydrogen carbonate.

**Observations Inferences**

***R – COOH present (½mk)***

***NOTE***

***Accept either of the following if given in place of the above structures for***

* ***carboxylic / alkanoic acid present***
* ***solution is acidic***
* ***H3O+ / H+ present***

***Effervescence / Bubbles of a colourless gas / fizzing (½mk)***

***NOTE***

***Reject: hissing / fizzling / sizzling / “colourless gas” on its own***

1. To the fifth portion add about 2cm3 of ethanol and warm the mixture.

**Observations Inferences**

***R-COOH, -COOH present (½mk)***

*(****Accept*** *for above in words for ½mk)*

*Ester formed if R-COOH is not mentioned).*

***N/B:***

*Penalize fully for any contradictory functional group.*

***Fruity / Pleasant smell (½mk)***

***Reject*** *:*

*Sweet smell*