**Name** ……..…….. **Index number** ….……

**School** ……..…….. **Candidate's sign**….……

**233/2**

**CHEMISTRY**

**PAPER 2**

**DECEMBER 2020**

**TIME: 2 HOURS**

# SUKELLEMO JOINT MOCK

*Kenya Certificate of Secondary Education (K.C.S.E*

**INSTRUCTIONS TO THE CANDIDATES:**

- Write your **name** and **index number** in the spaces provided above
- **Sign** and write the **date** of examination in the spaces provided.
- Answer ***all*** the questions in the spaces provided.
- All working **must** be clearly shown where necessary.
- Mathematical tables and electronic calculators can be used.

***For Examiners Use Only***

| Question | Maximum score | Candidate's score |
|---|---|---|
| 1 | 12 | |
| 2 | 12 | |
| 3 | 10 | |
| 4 | 10 | |
| 5 | 10 | |
| 6 | 14 | |
| 7 | 12 | |
| **Total** | **80** | |

***Answer all the questions in the spaces provided***

1. (a) Study the standard electrode potential for the half-cells given below and answer the questions that follow. *(The letters do not represent the actual symbols of the elements)*

| **Half-cells** | **$E^{o}$ (Volts)** |
|---|---|
| $N^{+}_{(aq)} + e^{-} \rightarrow N_{(s)}$ | -2.92 |
| $J^{+}_{(aq)} + e^{-} \rightarrow J_{(s)}$ | + 0.52 |
| $K^{+}_{(aq)} + e^{-} \rightarrow \frac{1}{2} K_{2(g)}$ | 0.00 |
| $^{1}\backslash_{2}G_{2(g)} + e^{-} \rightarrow G^{-}_{(aq)}$ | +1.36 |
| $M^{2+}_{(aq)} + 2e^{-} \rightarrow M_{(s)}$ | -0.44 |

(i) Identify the strongest reducing agent. Give a reason for your answer.( 2 marks)

……

……

(ii) Which two half- cells would produce the highest potential difference when combined? (1 mark)

……

……

(iii) Explain whetether the reaction represented below can take place. ( 2 marks)

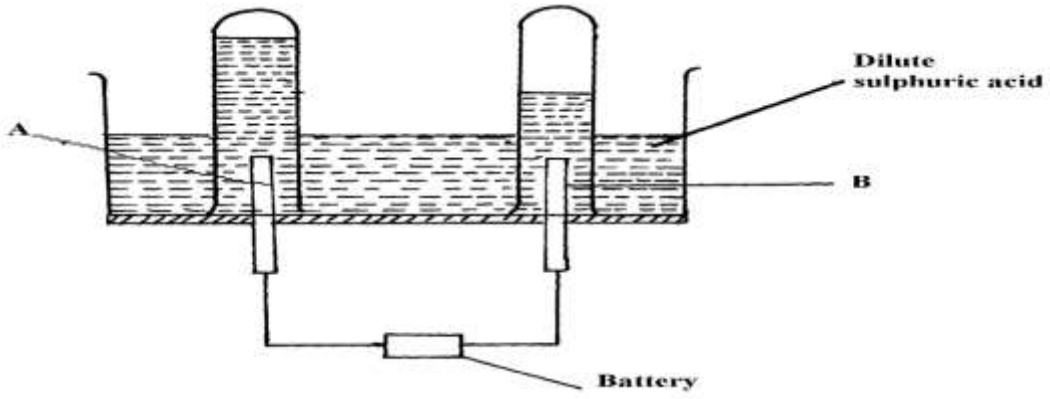
$2N^{+}_{(aq)} + M_{(s)} \rightarrow 2N_{(s)} + M^{2+}_{(aq)}$

……

……

……

(b) 100$cm^{3}$ of 2M sulphuric (VI) acid was electrolyzed using the set up represented by the diagram below.



(i) Name electrode A and electrode B (2 marks)

***A*** ……

***B*** ……

(ii) Write an equation for the reaction that produces gas L. (1 mark)

……

……

(iii) Describe how gas K can be identified (1 mark)

……

……

(iv) Explain the difference in:

I) The volume of the gases produced at the electrodes. (1 mark)

……

……

……

II) Brightness of the bulb if 100 $cm^3$ of 2M ethanoic acid was used in place of sulphuric (VI) acid. (2 marks)

……

……

……

……

2. The grid below presents part of the periodic table. Study it and answer the questions that follow. The letters are not actual symbols of the elements.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| A | | | | | | | | |
| B | | | | F | | H | J | N |
| C | | | P | G | | I | K | |
| D | | | | | | | L | |

a) State the family name of the following elements B, K and N. (3 marks)

***B-*** ……

***K-*** …….

***N-*** ……..

b) Give the formula of the compound formed between P and K. (1 mark)

……

……

c) Compare and explain the melting points of elements C, P and G. (2 marks)

……

……

……

……

d) Name the most reactive metallic and non- metallic elements. (1 mark)

Metallic- ……

Non-metallic – ……

e) Write the equation for the reaction that takes place between element C and water. (1 mark)

……

……

f) Compare and explain the first ionization energies of elements C and D. ( 2 marks)

……

……

……

……

g) Element B combines with chlorine to form a chloride of B. State the most likely pH value of a solution of a chloride of B. Explain ( 2 marks)

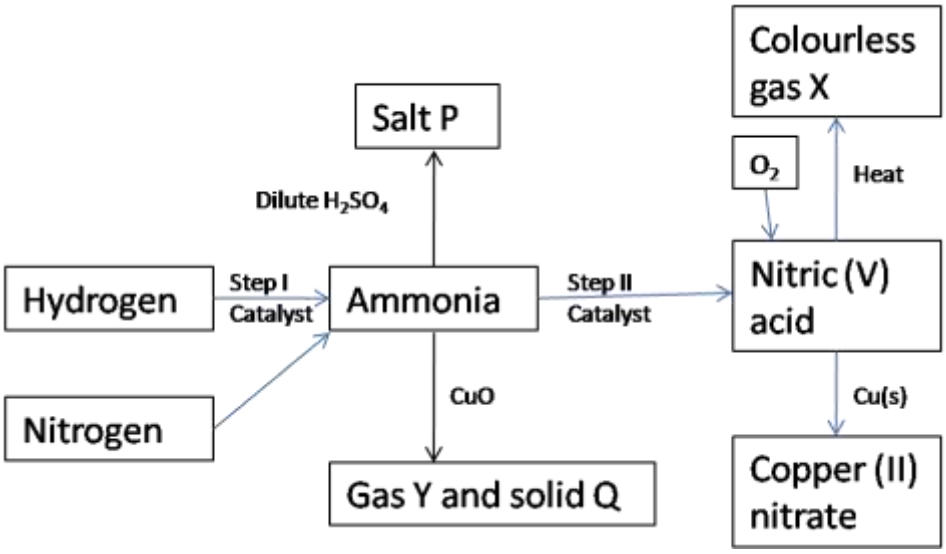
……

……

……

……

3. Study the scheme below and answer the questions that follow.




a) State one source of each of the following (2 marks)

(i) Hydrogen

……

(ii) Nitrogen

……

b) State two other conditions other than the use of catalyst that would favour the reaction in step I ( 2 marks)

……

……

……

c) Name the catalyst used in each of the steps I and II (2 marks)

Step I ……

Step II ……

d) Name the following substances

(i) Salt P ……(1 mark)

(ii) Gas X ……(1 mark)

(iii)Solid Q……(1 mark)

(iv)Gas Y……...(1 mark)

4. (a) The following data was obtained during an experiment to determine the molar heat of combustion of ethanol.

| | |
|---|---|
| **Volume of water used** | **=500cm$^3$** |
| **Initial temperature of water** | **=25$^o$c** |
| **Final temperature of water** | **= 44.5$^o$c** |
| **Mass of ethanol + lamp before burning** | **= 121.5g** |
| **Mass of ethanol+ lamp after burning** | **= 120.0g** |

Calculate the;

(i) The highest temperature change. (1 mark)

……

……

(ii) The mass of ethanol used to boil water. (1 mark)

……

……

(iii) Number of moles of ethanol used. (molar mass of ethanol=46.0g) (1 mark)

……

……

(iv) Heat evolved during the experiment (density of water-1g/cm$^3$, specific heat capacity of water=4.2Jg$^{-1}$K$^{-1}$). (2 marks)

……

……

……

(v) Molar heat of combustion of ethanol (C=12,O=16, H=1) (2 marks)

……

……

(vi) Write the thermochemical equation for the complete combustion of ethanol. (1 mark)

……

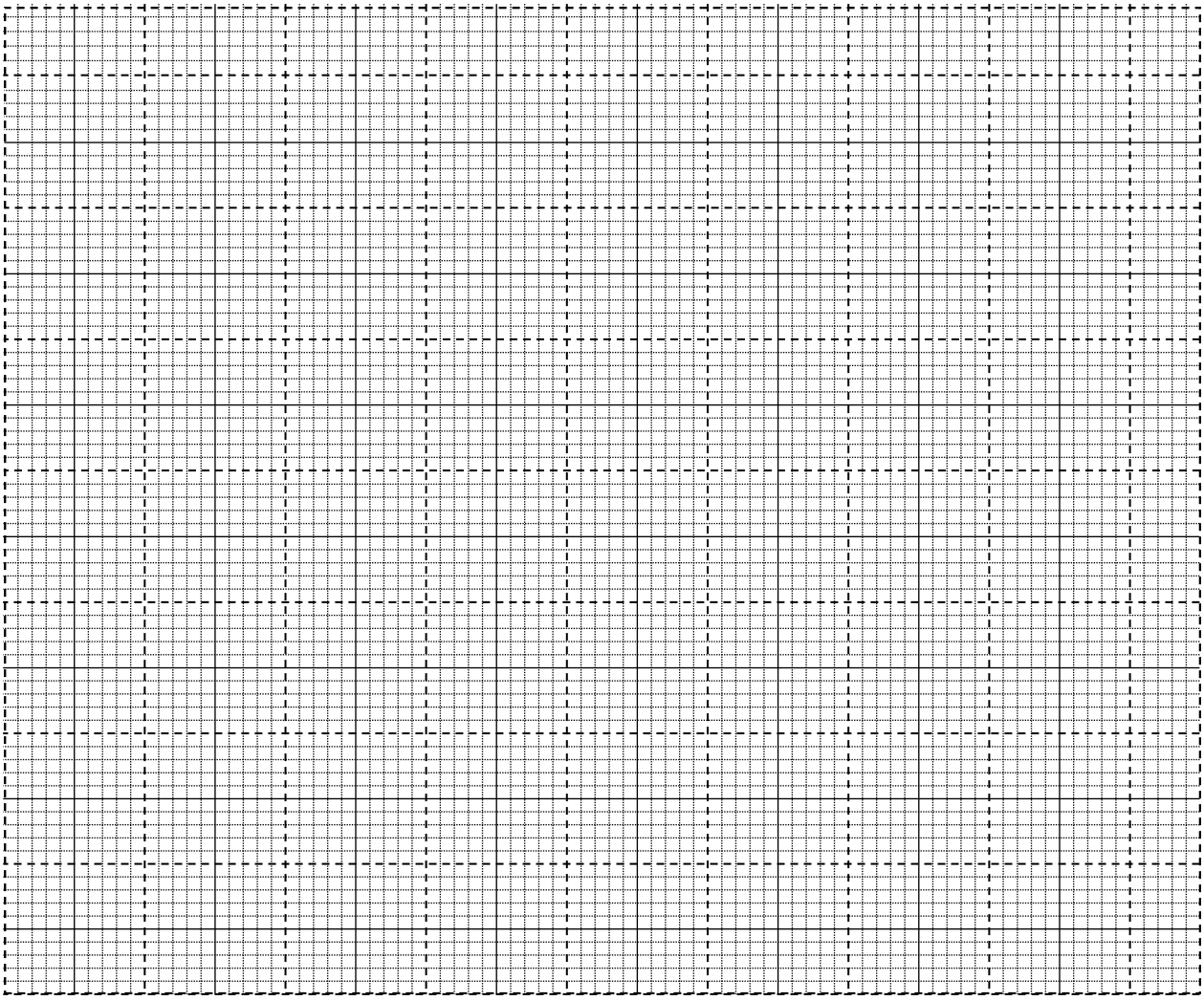
……

(vii) In the spaces provided, sketch a simple energy level diagram for the above change. (2 marks)

5. The table below contains information from the measurements made of the radioactivity in counts per minute from radioisotope iodine-128.

| Counts per minute | 240 | 186 | 170 | 156 | 143 | 122 | 108 |
|---|---|---|---|---|---|---|---|
| Time (minutes) | 0 | 15 | 20 | 25 | 30 | 40 | 50 |

(i) Plot a graph of counts per minutes against time. (3 marks)



(ii) Use the graph to determine the half-life of iodine 128. (1 mark)

……

……..

(iii) What is the count rate after: (2 marks)

(a) 12 minutes?……

(b) 22 minutes?.....……

(iv) After how many minutes was the count rate: ( 2 marks)

(a) 160 counts per minute?

……

……

(b) 197 counts per minute?

……

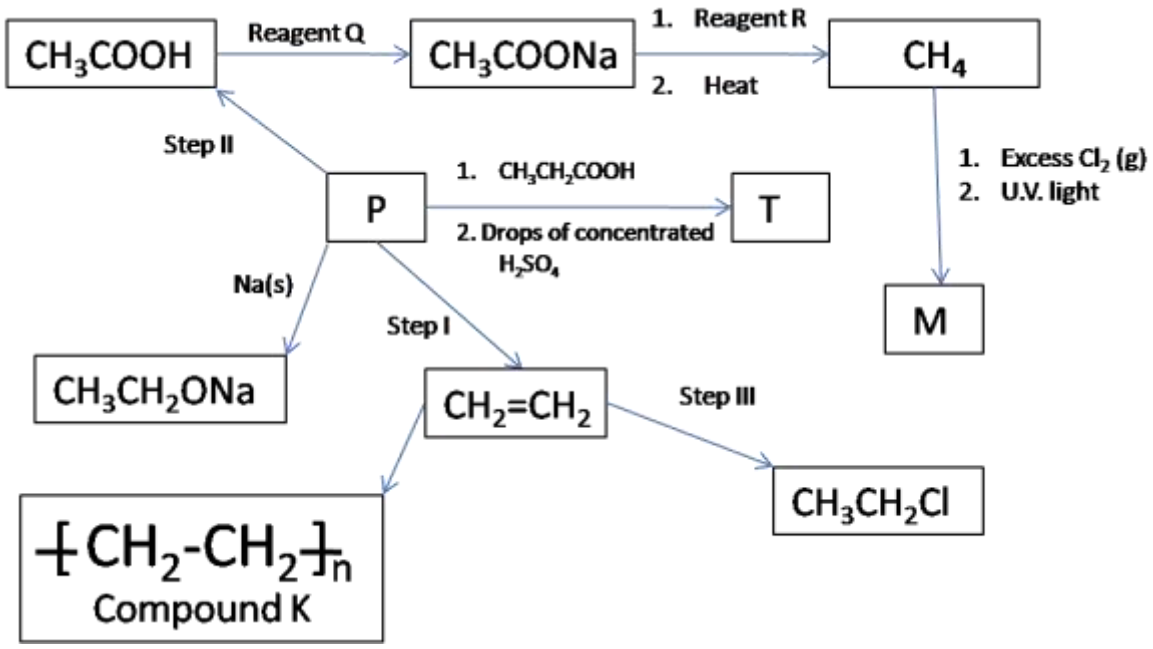
……

(v) State **two** uses of radioactive isotopes in agriculture. (2marks)

……

……

6. The scheme below shows some reactions starting with ethane. Study it and answer the following questions.




(i) Give the name and draw the structural formula of compound P. (2 marks)

(ii) Name the type of reaction and the reagents for the reactions in the following steps.

Step I Type (2 marks)

……..

Reagents

……..

Step II Type (2 marks)

……

Reagents

……

Step III Type (2 marks)

……

Reagents

……..

(iii) Name the **reagent Q**

……. (1 mark)

(iv) Give the name and the structure of compound T (2 marks)

Structure

Name……...

(v) Draw the structural formula of **M** and give name (1 mark)

Structure

Name……...

(vi) (I) Name compound K ……..... (1 mark)

(II) If the relative molecular mass of K is 84,000 determine the value of n (C=12, H=1) (1 mark)

……

……

……

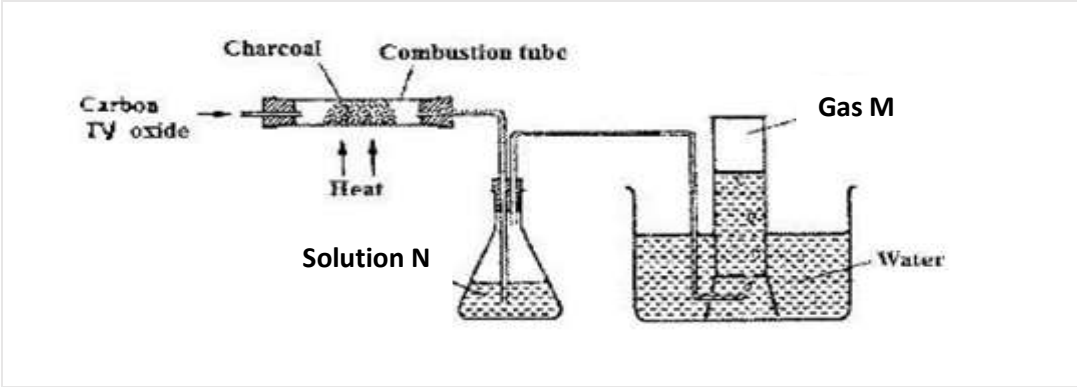
7. a) Name the allotropes of carbon. (1 mark)

……

……

……

b) Carbon (IV) oxide was passed over heated charcoal powder as shown in the set up below




(i) Name gas M …… (1 mark)

(ii) Write an equation for the formation of gas M (1 mark)

……

……

c) Identify **solution N** and state its purpose in the set up. (2 marks)

……

……

d) Carbon (IV) oxide does not support combustion yet burning magnesium continues to burn in it.

i) Explain this observation (1 mark)

……
……
……

ii) Write a chemical equation for the reaction that occurs. (1 mark)

……
……

e) Using dots **(.)** and cross **(x)** to represent outermost electrons, show the structure of a carbon (IV) oxide molecule. (2 marks)

f) Carbon (IV) oxide is used in the industrial manufacture of sodium carbonate.

(i) Name the other reagent in the Solvay process. (1 mark)

……
……..

(ii) Name the by product in this process and state any two of its uses. ( 2 marks)

……
……
……..
.....