**Name ……………………………………………Adm No…………… Class…………… School…………………………………Sign………………… Date………………………**

**233/2**

**CHEMISTRY**

**PAPER 2**

**(THEORY)**

**TIME: 2HOURS.**

**LANJET JOINT EVALUATION TEST, 2021**

*Kenya Certificate of Secondary Education.*

**INSTRUCTIONS TO CANDIDATES.**

* Write your name and index number in the spaces provided above.
* Answer **ALL** the questions in the spaces provided.
* Mathematical tables and silent electronic calculators may be used.
* All working **MUST** be clearly shown where necessary.
* Ensure that all pages are printed as indicated.
* This paper has 15 printed pages.

**FOR EXAMINER’S USE ONLY.**

|  |  |  |
| --- | --- | --- |
| **Questions** | **Maximum score** | **Candidates score** |
| 1 | 13 |  |
| 2 | 11 |  |
| 3 | 13 |  |
| 4 | 13 |  |
| 5 | 12 |  |
| 6 | 10 |  |
| 7 | 8 |  |
| **Total score** | **80** |  |

**1.** Sulphuric (VI) acid can be prepared using hydrogen sulphide as shown in flow chart below.

Study it and answer the questions that follow.

DRY HYDROGEN SULPHIDE

**SOLID C**

**BURNERS**

**OLEUM**

**AIR**

**CHAMBER D**

**ABSORPTION TOWER**

**GAS A**

**SULPHUR (VI) OXIDE**

**LIQUID B**

1. Identify:
2. Gas **A**:  (1 mark)

……………………………………………………………………………………………

1. Liquid **B**: (1 mark)

……………………………………………………………………………………………

1. (i) What function does solid C play in the chamber **D**? ( 1mark)

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……………………………………………………………………………………………

(ii) Write an equation for the reaction in chamber **D**. (1 mark)

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1. Explain the observations made if hydrogen sulphide gas is bubbled through copper (II) nitrate solution? (2 marks)

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(d)Write an ionic equation for the confirmatory test for hydrogen sulphide gas.1 mark)

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(e)Write a chemical equation to show the formation of concentrated Sulphuric (VI) acid from the oleum. (1 mark)

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(f)Explain why in contact process **SO3** gas is **not** directly dissolved in water to make concentrated sulphuric (VI) acid. (2 marks)

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(g)Name the main pollutant from the process above and how it is controlled. (2 marks)

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1. State two factors that increases the yield of sulphur (VI) oxide using the equation below. (1 marks)

**2SO2(g) + O2(g) 2SO3(g**) -ve

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2.a) During an experiment a student added soap solution to separate samples of water until

lather was formed. Below is a table showing the volumes of soap solution that was

required to form lather with **100cm3** of each sample of water before and after boiling

the samples.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Volume (cm3) of soap required by water sample** | | |
| **X** | **Y** | **Z** |
| Before boiling | 4.5 | 19.5 | 22.5 |
| After boiling | 4.5 | 19.5 | 4.5 |

1. (a)State the most likely source of water sample **X**. (1/2 mark)

……………………………………………………………………………………………

(b) Identify a salt most likely to be present in water sample **Y.** (1/2 mark)

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1. Write an equation for the reaction that may have occurred in water sample **Z** when it was being boiled. (1 mark)

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b) Study the flowchart below and answer the questions that follow.



1. Name the types of reaction that occurs in steps **I** and **II**

Step I : …………………………………….. (1/2 mark)

Step II : **……………………………………** (1/2 mark)

1. What conditions are necessary for the reaction you have named in (i) above? (11/2 mark)

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1. Write a chemical equation for the reaction that takes place in step **IV**  (1 mark)

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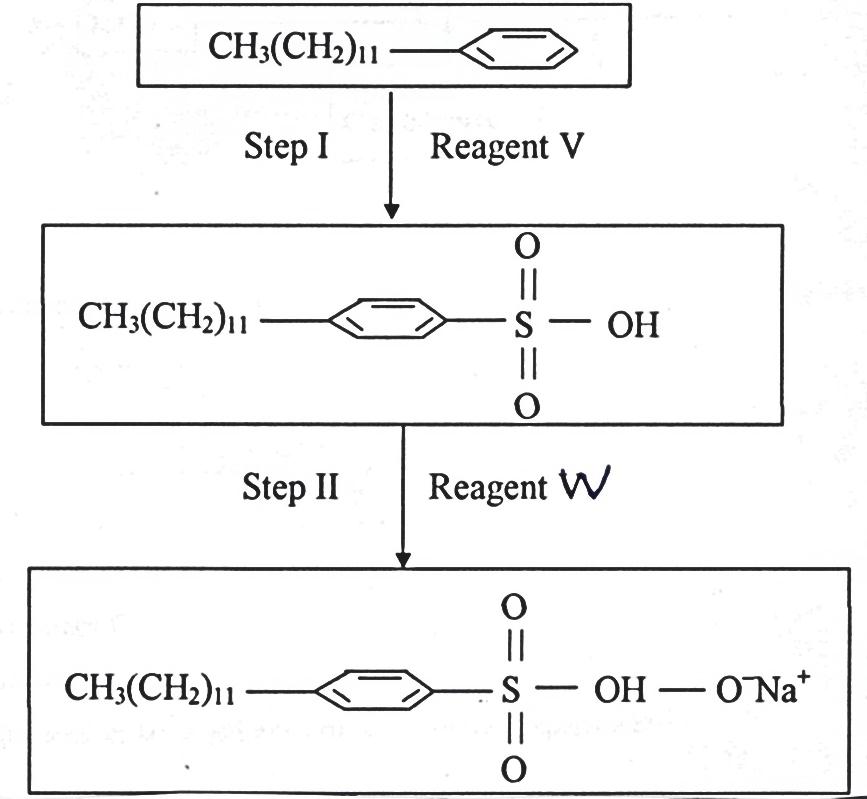
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1. Why is substance **R** used in some soaps? (1/2 mark)

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c) The flow diagram below shows some of the steps followed during the industrial manufacture of a detergent.



i) What is a detergent? (1 mark)

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ii) Identify reagents **V** and **W** (2 marks)

1. Reagent **V** ……………………………………………………………..
2. Reagent **W** ……………………………………………………………

iii) Write an equation for the reaction that may occur when the detergent is added to water containing magnesium ions. (1 mark)

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iv) State **one** advantage of using the above detergent. (1 mark)

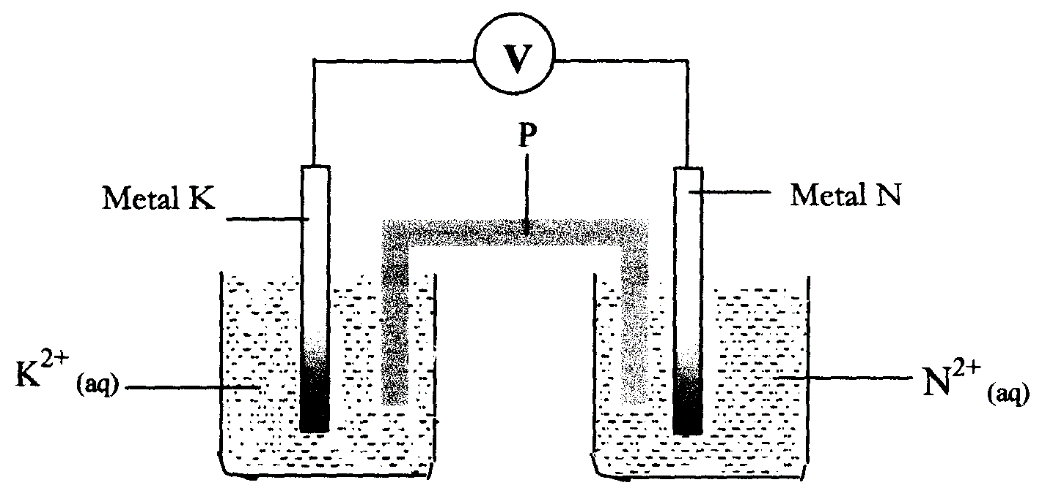
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3. Metals **K** and **N** were connected to form a cell as shown in the diagram below. Their reduction potentials are as shown below:

**K+(aq) / K(s) ≡ - 0.17V**

**N+(aq) / N(s) = + 1.1 6V**



I. Write the equation for the half-cell reaction that occurs at

Metal **K** electrode (1mark)

***………***..........................................................................................................

Metal **N** electrode (1mark)

......................................................................................................................

II) Identify **P** and state **two** roles in the above setup

(i). Identity of **P**  (1 mark)

……………………………………………………………………………………………

1. **Two** Roles of **P** in the setup. ( 1 mark)

…………………………………………………………………………….

III. On the diagram, show the flow of :-

I. Electrons (1/2 mark)

……………………………………………………………………………………………

……………………………………………………………………………………………

II. Current. (1/2 mark)

……………………………………………………………………………………………

……………………………………………………………………………………………

IV Calculate cell potential (E) for the cell represented in the setup above (1 mark)

……………………………………………………………………………………………

……………………………………………………………………………………………

(b) The table gives the standard redox potentials for a number of half reactions. Use it to answer the questions that follow:-

**(Eθ/Volts)**

Zn2+ (aq) + 2e- Zn(s) -0.76

Fe2+ (aq) + 2e- Fe(s) -0.44

I2+ (l) + 2e- 2I- (aq) +0.54

Fe3+ (aq) + e- Fe2+(aq) +0.77

Ag+ + e- Ag(s) +0.88

1. Relative to which half-cell reaction are the above electrode potentials expressed?

(1/2 mark)

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(ii) Calculate the e.m.f of the cell made up by combining the **I2(l) /2I-(aq)**electrode and

**Zn2+(aq)/Zn(s)** electrode (1marks)

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(ii) Which of the substances listed in the above table is :- ( 1marks)

1. The strongest oxidising agent

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……………………………………………………………………………………………

1. The strongest reducing agent

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(iv) Which substances could be used to convert iodide ions to iodine? Write balanced equations for any possible conversions (1mark)

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(v) Draw a cell diagram formed between zinc and lead. (2marks)

c) A steady current of **2.5A** was passed for **15** minutes through a cell containing divalent ions

**M2+**. During this process **0.74g** of metal M was deposited (IF = **96500C**)

Calculate the quantity of electricity passed in this cell (1mark)

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ii) Determine the relative atomic mass of **M** (2marks)

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4. In an experiment, a student measured the amount of gas produced with time when excess **1.0** **M** hydrochloric acid was reacted with **0.42** g of a carbonate, **XCO3** and obtained the following results. (Note: The reaction was carried out at room temperature)

|  |  |
| --- | --- |
| **Time (minutes)** | **Volume of carbon (IV) oxide, cm3** |
| 0.0 | 0 |
| 0.5 | 20 |
| 1.0 | 32 |
| 2.0 | 52 |
| 5.0 | 86 |
| 7.5 | 103 |
| 10.0 | 112 |
| 12.0 | 118 |
| 14.0 | 120 |
| 16.0 | 120 |
| 18.0 | 120 |

a) On the graph paper provided, draw a graph of volume of carbon (IV) oxide against time.{3 mks}



b) From the graph,

i) Determine the time at which half the original mass of marble chips will have reacted.

(1 mark)

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1. Determine the reaction rate between the **5th** and **6t**h minutes. (2 marks)

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c) i)Write the equation for the reaction that takes place. (1 mark)

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ii) Calculate the total number of moles of carbon (IV) oxide produced in this reaction.

(Molar gas volume at **r.t.p = 24 dm3**) (2 marks)

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iii) Determine the relative molecular mass of **XCO3**. (2 marks)

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iv) Determine the relative atomic mass of **X.** (1 mark)

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d) On the same graph paper, draw a sketch of the curve that would be obtained if **0.5 M** hydrochloric acid was used. Label the curve A. (1 mark)

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5. Sodium metal tarnishes when exposed to air to form a white powder on its surface. A small piece of sodium metal was dropped into **30 g** of propanol and **2400cm3** of hydrogen gas produced at room temperature and pressure .The unreacted propanol was evaporated and white solid remained .( molar Gas Volume at room temperature and pressure =**24dm3** **Na=23** , **C=12** , **O= 16**)

a) (i)Give the name of the white powder formed on the original piece of sodium metal. (1mark)

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(ii)Explain how the white solid was formed. (2marks)

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b) (i)White down the chemical equation for the reaction between propanol and sodium metal. (1mark)

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(ii)Determine the mass of sodium that reacted with propanol. (2marks)

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(iii) What mass of propanol was evaporated? (2 marks)

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(iv) The propanol was evaporated at **970c** and the white solid remained unaffected at this temperature .what is the difference in structure of propanol and white solid. (1 mark)

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c) (i)Name the inorganic liquid which liberates hydrogen gas with sodium metal. (1 mark)

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(ii)State two differences you would observe if similar pieces of sodium metal were dropped

separately into beakers containing equal amount of propanol and liquid named in (i)

above respectively. (2marks)

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6. The figure below is a section of periodic table. Study and answer the questions that follow. The letters do not represent the actual symbol of elements.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **A** |  | | | | | | |  |
|  |  |  |  |  | **D** |  | **I** | E |
| **F** | **G** |  | **H** |  |  |  |  |  |
| **J** |  |  |  |  |  |  |  |  |

(i) Select the elements which belongs to the same chemical family. (1/2 mark)

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(ii)Identify the strongest reducing element. (1/2 mark)

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b) (i) The chloride of **H** vaporizes easily while the oxide of **H** has a high melting point. Explain

the observation in terms of structure and bonding. (2marks)

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(ii)Blue and red litmus papers were dropped into solution of chloride of H, state and explain the observations made. (1mark)

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……………………………………………………………………………………………

c) **K-**has ionic configuration of **2:8:8**

(i) Give the chemical family name to which element **K** belong. (1mark)

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(ii) Place element K on the above periodic table. ( 1mark)

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d) The first and second ionization energies of element **G** at random are **665**kjmol- and **560** kjmol-

(i) Define the term the ionization energy. (1mark)

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……………………………………………………………………………………………

(ii) Write equations for the first and second ionization energies for element **G indicating their energies**. (1 mark)

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(iii) Explain your answer in (ii) above. (1mark)

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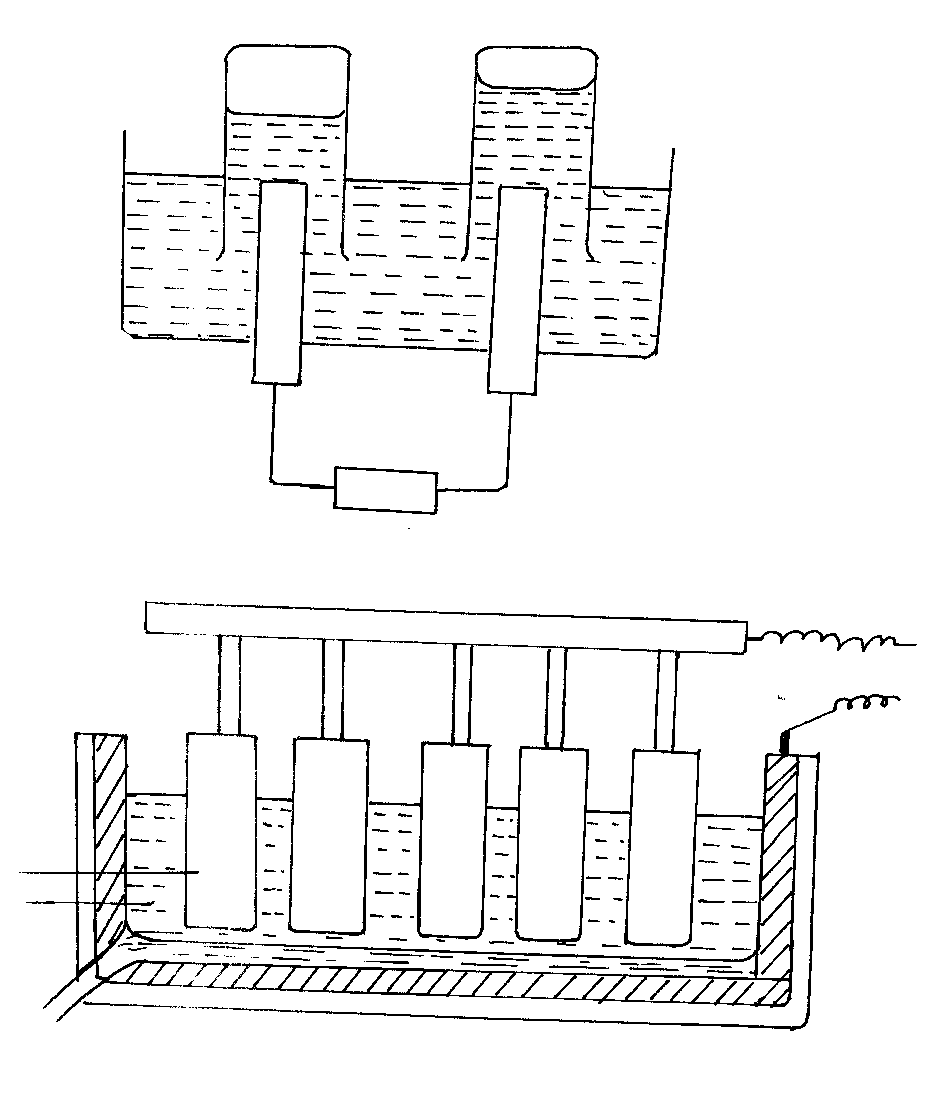
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e) Explain the difference in the atomic radii of **D** and **I.** (1mark)

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**7.** The diagram below illustrates the Hall’s cell for the extraction of Aluminium. Study it and answer the questions that follow.



**G**

**Molten Aluminium**

**Electrolyte**

1. (i) Name the electrode labeled **G** (1 mark)

……………………………………………………………………………………………

(b) Electrolysis is carried at **800 – 9000C** and newly formed Aluminium is tapped off as a

liquid. What does this indicate about the melting point of Aluminium? (1 mark)

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(c) (i) Give the ionic equations for the reaction that takes place at the cathode. (1 mark)

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(ii) The anode has to be replaced frequently. Explain. (1 mark)

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……………………………………………………………………………………………

d) Cryolite is used in the extraction of aluminium from bauxite. State its function. (1mark)

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d) A piece of unpolished aluminium foil is not attacked by water steam and dilute hydrochloric acid. Explain. (1mark)

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……………………………………………………………………………………………

e) (i) The basic raw material for extraction of aluminium is bauxite. Name two major impurities in bauxite. (1 mark)

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……………………………………………………………………………………………

(ii) State one property of duralium that make it more suitable than pure aluminium in aeroplane construction. (1 mark)