NAME:.....

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545/2
CHEMISTRY
Paper 2
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2 Hours

PROVINCIAL - NAMIREMBE DIOCESE
COUHEIA SECONDARY
MOCK EXAMINATIONS 2023

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Uganda Certificate of Education

CHEMISTRY

Paper 2

2 Hour

INSTRUCTIONS:

1. This paper consists of 10 structured questions in section A and 4 semistructured questions in section B.
2. Answer all the 10 questions in Section A in the spaces provided. Select only two questions from section B and answer on the separate answer sheets provided.
3. In all cases show your working clearly.
4. Where necessary use: (H=1, C=12, O = 16, Na = 23, P = 31.
   (1 mole of gas at S.t.p occupies 22.4dm^3; 1 mole of gas occupies 24dm^3 at room temperature)

For Examiners use only.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	TOTAL

SECTION A (50MARKS)

1. a) State with a reason whether the following process is a physical or a chemical change.

i) Water electrolysis (½mark)

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Reason (1mark)

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ii) Separating vinegar and water by distillation. (½mark)

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Reason (1mark)

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b) Distillation method can be used to remove hardness from water.

State;

i) the property that is the basis for using distillation method. (1mark)

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ii) One advantage of the method

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(½ mark)

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iii) one disadvantage of the method

(½ mark)

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2. Below are some of the properties of elements P, Q, R, and T. Use them to answer the questions that follow. The letters are not the actual symbols of the elements.

Element	Properties
P	Is the only non-metal that forms a neutral , liquid oxide at room temperature Burns with a pop sound in presence of a strong flame
Q	• Is in period 3, forms an amphoteric oxide of formula Q_2O_3 • Does not react with water but the heated element reacts with steam.
R	• Is in period 2 , Forms two oxides , a neutral but very poisonous monoxide and an acidic dioxide that turns lime water milky.
T.	• Does not form compounds • Is in same period of the periodic table as P.

a) Write the electronic configuration of element.

Q:..... (½ mark)

R:..... (½ mark)

b) Identify which element;

i) Is a noble gas (½ mark)

.....

ii) Is commonly used to make food containers. (½ mark)

.....

iii) Is a metal (½ mark)

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C) Draw in the space below the structures of the compounds formed between

i) R and P (1mark)

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ii) Q and oxygen (1mark)

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d) State one property of the compound formed between Q and oxygen. (½ mark)

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3. Aqueous Lead (II) nitrate reacts with aqueous potassium iodide as shown below:

$Pb(NO_3)_2(aq) + 2KI(aq) \longrightarrow PbI_2(s) + 2KNO_3(aq)$

a) Name a method;

i) that could be used to separate the products. (1mark)

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ii) that could be used to obtain pure crystals of KNO_3 (1mark)

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b) Suggest;

i) a reason for the choice of the method given in (a)(ii) above. (1mark)

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ii) one practical application of the reaction above. (1mark)

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c) State what would be observed when the pure dry crystals of KNO_3 are strongly heated in a dry test tube. (1 ½ marks)

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4. Two different atoms of phosphorus are $^{31}_{15}P$ and $^{32}_{15}P$ and two the different forms of phosphorus are, **white phosphorus** and **Red phosphorus.**

a) What chemical term is used to describe;

i) the two different atoms of phosphorus? (½ mark)

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ii) the two different forms of phosphorus? (½ mark)

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b) State;

i) One difference between the two atoms. (½ mark)

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ii) One similarity between the two atoms. (½ mark)

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c) i) Identify the form of phosphorus that smolders when exposed to air. (½mark)

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ii) Suggest any precaution taken to prevent the smoldering . (½ mark)

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d) Phosphorus forms simple molecules which have a relative molecular mass 124. Suggest the molecular formula of the molecules. (1mark)

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e) Phosphorus has a low melting point and does not conduct electricity. Suggest a reason why;

i) phosphorus has a low melting point. (½ mark)

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ii) Phosphorus does not conduct electricity. (½ mark)

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5. During the preparation of copper(II) sulphate crystals using copper metal and concentrated sulphuric acid, after effervescence has ceased a dark brown residue is left.

a) Name the two components present in the dark brown residue. (2 marks)

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b) Write equation for the reaction leading to formation of;

i) Copper (II) sulphate in solution. (1 ½ marks)

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ii) Copper (II) sulphate crystals from their aqueous solution. (1mark)

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c) State what is observed when dry crystals of copper (II) sulphate are gently heated. (½ mark)

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6. a) Concentrated aqueous sodium chloride was electrolysed using graphite electrodes . Name the product(s) formed at ;

i) the positive electrode. (1 mark)

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ii) the negative electrode. (½ mark)

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b) Write the half equation for the reaction at the negative electrode. (1mark)

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c) Chlorine gas can be prepared on a large scale by electrolysis of concentrated aqueous sodium chloride according to the overall equation below.

$2NaCl(aq) + 2H_2O(l) \longrightarrow 2NaOH(aq) + Cl_2(g) + H_2(g)$

i) What common name is given to concentrated aqueous sodium chloride? (½ mark)

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ii) If $55dm^3$ of $3.5mol/dm^3$ of sodium chloride solution is completely electrolysed, what is the maximum volume of chlorine that can be formed and measured at room temperature and pressure? (2marks)

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7. Petroleum (Crude oil) is a mixture of **hydrocarbons** and the refinery gas fraction known as natural gas contains **methane, ethane** and **propane**

a) State what is meant by the term **hydrocarbons.** (1mark)

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b) State;

i) the component with mole percentage 94.7% in natural gas. (½ mark)

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ii) the homologous series to which the hydrocarbons in natural gas belong. (½ mark)

.....

iii) the general formula of the homologous series that contains methane, ethane and propane. (½ mark)

.....

iv) the common name of the homologous series containing natural gas. (½ mark)

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c) Give one use of each of the following components of petroleum.

i) Kerosene (½ mark)

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.....

ii) naphtha (½ mark)

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.....

d) Name

i) one non-energy component found in natural gas. (½ mark)

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ii) the process by which long chain hydrocarbons are broken down to simpler ones. (½mark)

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8. Ethanoic acid, CH_3COOH is **a monobasic acid and is considered a weak acid.**

a) State what is meant by the terms;

i) **Monobasic acid.** (1mark)

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ii) **Weak acid.** (1mark)

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b) The melting point of ethanoic acid is 16.7°C and the boiling point is 118°C.

i) Deduce the physical state of ethanoic acid at 130.0°C. (½ mark)

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ii) Suggest a reason for your deduction. (½ mark)

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c) Ethanoic acid reacts with sodium carbonate according to the equation below.

$2CH_3COOH(aq) + Na_2CO_3(aq) \longrightarrow 2CH_3COONa(aq) + CO_2(g) + H_2O(l)$

A student added 3.18g of sodium carbonate to 224cm^3 of 0.250 M ethanoic acid. Determine which of the two reagents was added in excess. (2marks)

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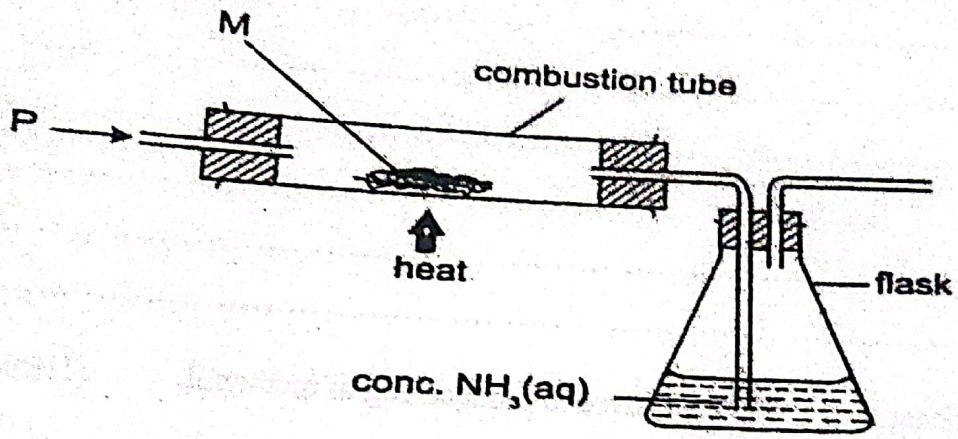
9. The diagram below represents a set-up for the reaction between chlorine and aluminium



a) Identify;

P:..... (½ mark)

M:..... (½ mark)

b) Name the substance dissolved in concentrated ammonia solution. (½ mark)

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C) Write the equations for the reactions taking place in;

i) in the combustion tube. (1 ½ marks)

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ii) in the flask (1 ½ marks)

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10. The formation of methanol from carbon(II) oxide and hydrogen gas can be represented by;

$CO(g) + 2H_2(g) \rightleftharpoons CH_3OH(g) \quad \Delta H = -92\ kJmol^{-1}$

a) Determine;

i) the mass of carbon (II) oxide would react to give 16g of methanol? (2marks)

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ii) the amount of heat that would be evolved to produce 16g of methanol. (1½marks)

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b) State what would happen to the amount of methanol if temperature is increased. Give a reason to support your answer. (1 ½ marks)

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SECTION B (30MARKS)

Attempt any two questions

11. a) i) Name the process by which both the anhydrous and crystalline states of sodium carbonate can be obtained on a large scale. (1mark)

ii) Name the raw materials for the process you have named in a) i) above. (1½marks)

iii) Give the common names of both the anhydrous and crystalline forms of sodium carbonate. (1mark)

b) Write equations for the reactions leading to formation of ;

i) Anhydrous sodium carbonate and
ii) crystalline sodium carbonate from the raw materials named a) i) above. (4 ½ marks)

c) Name in each case;

i) the raw material which is recycled back into the process. (½ mark)

ii) the by-product of the process. (½ mark)

d) Write an equation leading to the formation of the two substances named in c) i) and c) ii) above, (1 ½ marks)

e) Suggest one industrial use in each case of;

i) the anhydrous state of sodium carbonate. (1mark)

ii) the crystalline state of sodium carbonate. (1mark)

f) When 20.1g of crystalline sodium carbonate, $Na_2CO_3.xH_2O$ was strongly heated, 8.1g of anhydrous sodium carbonate was left as residue. Calculate the value of x. (2 ½ marks)

12.a) In an experiment to prepare carbon dioxide Akili added dilute hydrochloric acid to;

A: 20g of Large lumps of marble chips,

B: 20g of powdered marble chips

C: 20g of small lumps of marble chips and also tried out with

D: 10g of powdered marble in a conical flask. Volumes of carbon dioxide were obtained at constant time intervals in seconds under the different conditions.

Draw on the same axes sketches curves that Akili could have plotted using her findings and label them A, B, C and D respectively. (3marks)

b) A piece of calcium carbonate was put into a beaker containing excess of dilute hydrochloric acid which was placed on a reading balance. The weight of the beaker and contents was then recorded every 2 minutes as shown below.

Time(minutes)	0	2	4	6	8	10	12
Mass(g)	126.44	126.31	126.19	126.09	126.03	126.00	126.00

i) Plot a graph of mass in against time. (4marks)

ii) Write an equation for the reaction that took place min the beaker. (1mark)

iii) Determine the rate of reaction at 1.4 minutes and at 5minutes. (2marks)

iv) Explain the difference in the values of rates of reaction at 1.4 minutes and 5 minutes. (2marks)

v) State two different ways by which the reaction could have been made more rapid. (1mark)

vi) The final solution in c) i) was evaporated to dryness and the mass of the beaker and remaining solid residue was 97.63g. The beaker was left open and the following day the mass was 98.63g. Explain what had happened to cause the change and name the process. (2marks)

13. Sodium metal is extracted by **electrolysis** method from its principal ore and calcium chloride is usually added to the ore. Iron metal on the other hand is extracted by **carbon reduction** method from one of its ores known as iron pyrites, FeS_2

a) i) Define the **'an ore'.** (1mark)

ii) Suggest a reason for the choice of method of extraction of sodium and iron metal (2marks)

iii) Give the name and formula of the principal ore of sodium. (1mark)

iv) Suggest two reasons why calcium chloride is added to the ore of sodium. (2marks)

b) Name the method that can be used to concentrate iron pyrites and write an equation for the reaction that takes place. (2marks)

c) During the extraction of iron **limestone** and **coke** are added to the concentrated ore. Explain with the aid of equations where necessary the role of addition of ;

i) Lime stone

ii) Coke (3 ½ marks)

14. a) Ammonia gas can be prepared in the laboratory by heating a mixture calcium oxide and ammonium chloride. (3 ½ marks)

i) Write an equation and state the condition(s) for the reaction that takes place. (2 marks)

ii) Name another substance that can be used instead if calcium oxide. (½ mark)

b) i) Name the substance used to dry ammonia gas. (½ mark)

ii) Explain with the aid of equations why concentrated sulphuric acid and anhydrous calcium chloride are not suitable drying agents for ammonia. (4 ½ marks)

c) Ammonia gas cannot be collected over water. Using an equation explain this observation. (2marks)

d) Write an equation for the reaction of ammonia with air enriched with oxygen;

i) Alone (1 ½ marks)

ii) in presence of red-hot platinum-rhodium gauze (1 ½ marks)

e) Ammonia gas was bubbled through an aqueous solution of zinc sulphate until there was no further change.

i) State what was observed. (1 ½ marks)

ii) Write the name and formula of the ion responsible for the final observation. (1mark)

-END-