Name……

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545/2

CHEMISTRY

Paper 2

April 2023

NATIONAL ASSOCITION OF CHEMISTRY TEACHERS

Uganda Certificate of Education

CHEMISTRY

Paper 2

TIME:2HRS 30min

INSTRUCTIONS

Section A consists of 10 structured questions. Answer all questions in this section

Answers to these questions must be written in the spaces provided

Section B consists of 4 semi structured questions

Answer any two questions from this section

Answers to section B must be written in the answer booklet/ sheet provided and stapled at the back of the question paper

Show all your working clearly in both sections

Where necessary use

(Ca=40, K=39, O=16, H=1, 1 Molar gas volume at s.t.p=22.4dm^3)

For examiners' use only

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total

SECTION A (50 marks)

Answer all questions in this section

1. Mention the method that can be used to separate the pairs of the following mixtures
   a) Water and diesel (1 mark)
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      ……
      ……
   b) Water and ethanol (1 mark)
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      ……
      ……
      ……..
   c) Pigments of green leaf (1 mark)
      ……
      ……
      ……
      ……
   d) Potassium chloride and sodium chloride (1 mark).
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      ……..
      ……
      ……
2. a) An element W has mass number 27 and 14 neutrons

   i)Write down the electronic configuration of W ($1/_2$ marks)

   ……
   ……

   ii) W combines with oxygen to form compound R

   Write down the formula of R and state the type of bonding (1 mark)

   Formula……
   ……

   Type of bonding……
   ……

b) Write an equation of reaction between R and dilute hydrochloric acid ($1^1/2$ marks)

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……

3(a). An organic compound X has a molecular formula C_2H_4

II) Write the name and the structural formula of X (2 marks)

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……

b) Compound X was bubbled through bromine liquid

i) Write the structure of the compound (1 mark)

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……

ii) What is the role of bromine liquid in the experiment? (1 mark)

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……

iii) Name one other compound that can be used instead of bromine liquid (I mark)

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4(a) Name two compounds that can be used to prepare sulphurdioxide in the laboratory (2 marks)

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……

b(i) Write equation of reaction that takes place when a mixture of two compounds named in a(i) above is heated ($1^1/2$ marks)

(ii)State how the gas can be dried in the laboratory (1 mark)

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……

5. A Hydrocarbon Z contains 82.76% carbon. The formula mass 0f Z is 58g

a) Calculate the;

i) Simplest formula of Z (2 marks)

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……

ii) Molecular formula of Z ($1^1/2$ marks)

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b) Write the molecular formula of Z (1 mark)

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……
……

ii) Equation of complete combustion of Z ($1^1/2$ marks)

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……

6. The setup of apparatus in the figure below was used to investigate the effect of heat on zinc carbonate

a) State what was observed in

i)Test tube X (1 mark)

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……
……

ii) Test tube Y (1 mark)

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……

b) Write an equation for the change that occurs in

i) Test tube X ($1^1/2$ marks)

ii) Test tube Y ($1^1/2$ marks)

c) State one use of the solid product in b(ii) (1 mark)

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……

7(a) i) Name one substance which when reacted with hydrogen peroxide can produce oxygen (1/2 marks)

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……

ii) Write down an equation of reaction leading to the formation of oxygen ($1^1/2$ marks)

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……

b) Write down the equation for the reaction that takes place when

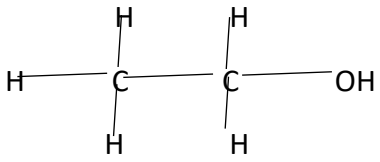
i) Hydrogen is burnt in oxygen ($1^1/2$ marks)

……
……

ii) Sodium is burnt in a limited supply of oxygen ($1^1/2$ marks)

……
……

8 The structure of an organic substance A is shown below



a) Name substance A (1 mark)

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……
……

b) A reacts with excess concentrated sulphuric acid at 170^oc to form an organic product B

i) Name B (1 mark)

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……
……

ii) Write equation leading to the formation of B ($1^1/2$ marks)

iii) Name one reagent that can be used to detect for the presence of B (1 mark)

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……
……

iv) State what would be observed if the reagent in (iii) was used (1 mark)

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……

9.

Sample of water	Volume of water needed to form lather before boiling	Volume of water needed to form lather after boiling
A	15	15
B	5	5
C	20	3

a) Identify which sample of water is ($1^1/2$ marks)

i) Soft

……
……

ii) Temporarily hard

……
……

iii) Permanently hard

……
……

b) Write equation to show how boiling removes hardness from water ($1^1/2$ marks)

c) State two disadvantages of hard water (1 mark)

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10(a) Define the term

i)Isotopy (1 mark)

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……..

ii) Allotrope (1 mark)

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……..

b) Name one common element that exhibit both isotopy and allotropy (1/2 marks)

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d) Give one example of;

i) The isotopes of the element that you have named in b(1/2 marks)

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……..

ii) The allotrope of the element you have named in (b)(1 mark)

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……..

SECTION B

ATTEMPT ANY TWO QUESTIONS FROM THIS SECTION

11(a) an atom of element X has 17 protons

i)State the number of neutrons in X (1 mark)

ii) Write the electronic configuration of X (1 mark)

b(i) write the formula of the ion of X (1 mark)

ii) Write the formula and compute the compound formed when sodium combines with X (1 mark)

iii) State the type of bond in compound formed in b (i) above (1 mark)

iv) Outline four properties of the compound formed in b(ii) above (4 marks)

c)the product of reaction between sodium and X was dissolved in water and the resultant solution reacted with lead (ii) nitrate solution and the mixture boiled

i) State what was observed (2 marks)

ii) Write equation for the reaction between the solution and lead (ii) nitrate ($1^1/2$ marks)

d) Using outermost shells only show the bonding between carbon and element X ($2^1/2$ marks)

12(a) (i) State the conditions under which sulphuric acid reacts with ethanol to form ethane ($1^1/2$ marks)

ii) Write an equation for the formation of ethane from ethanol and sulphuric acid ($1^1/2$ marks)

iii) Name the property of sulphuric acid shown by the reaction in a (ii) above (1 mark)

b) name one reagent apart from bromine that can be used to distinguish between ethane and ethene and in each case state what is observed if the reagent is separately treated with ethene and ethane ($2^1/2$ marks)

c) A hydro carbon T of molecular mass 42 contains 85.7% carbon

i) Calculate the empirical formula of T (2 marks)

ii) Calculate the molecular formula of T (2 marks) (C=12, H=1)

iii) Write the structural formula of T (1 mark)

e) T was reacted with bromine. State what was observed and write an equation for the reaction that took place ($2^1/2$ marks)
i)identify the product formed (1 mark)

13 Sulphur as an element consists of two major allotropes

a) Define allotrope and name the two major allotropes of sulphur (3 marks)
b) Sulphurdioxide gas is prepared in the laboratory from sodium sulphite crystals and an acid

i)name the acid used and state the conditions for the reaction ($1^1/2$ marks)

ii) Write an ionic equation between sodium sulphite crystal and the acid you have named in b (i) above ($1^1/2$ marks)

iii) Briefly explain how a pure sample of sulphurdioxide gas can be prepared in the laboratory using sodium sulphite named acid (diagram not required) (3 marks)

c) Briefly explain with the aid of equations where necessary why sulphurdioxide gas

i)turns acidified potassium dichromate solution from orange to green (1/2 marks)

ii) Turns dump blue litmus paper red and finally white (1 mark)

d) Sulphurdioxide gas is used as a raw material in the manufacture of sulphuric acid by the contact process

i) Name the source of sulphurdioxide in the contact process (1 mark)

ii) Outline with the aid of equations the reactions which take place during the contact process stating from sulphurdioxide (3 marks)

iii) State one use of sulphuric acid (1/2 marks)

13. a) Excess copper(II)Oxide was added to warm dilute nitric acid.

i) State what was observed. *(1mark)*

ii) Write equation for the reaction that took place. *(1½ marks)*

iii) Briefly describe how crystals of copper(II) nitrate can be obtained from the reaction mixture in (a) (ii). *(4marks)*

b) To a mixture, magnesium nitrate and Lead (II) nitrate was added dilute sodium hydroxide dropwise until the alkali was in excess.
The resultant mixture was filtered. Name the cation that was in;

i) the filtrate *(½ mark)*

ii) the residue *(½ mark)*

c) i) Name <u>one</u> reagent that would be used to identify the cation that was in the filtrate and state what would be observed to confirm the presence of the cation. *(1½ marks)*

ii) Write equation for the reaction that would take place. *(1½ marks)*

d) Describe how that cation in the residue would be identified. Illustrate your answer with equations where applicable). *(4 ½ marks)*

14. a) Ethanol, C_2H_5OH, is used as a fuel and its enthalpy of combustion can easily be determined experimentally.

i) Define the term 'fuel' *(1mark)*

ii) State one use of ethanol other than as a fuel. *(1mark)*

iii) Explain what is meant by the term 'enthalpy of combustion." *(2marks)*

iv) Write equation of the combustion of ethanol in air containing plenty of oxygen. *(1½ marks)*

b) The formulae and enthalpies of combustion of some four alcohols are shown in the table below.

Alcohol	CH_3OH	C_3H_7OH	C_4H_9OH	$C_5H_{11}OH$
Enthalpy of combustion ($kJmol^{-1}$)	-715	-2020	-2680	-3320

i) Plot a graph of enthalpy of combustion against number of carbon atoms for the four alcohols. *(4marks)*

ii) From your graph, determine the enthalpy of combustion of ethanol. *(1mark)*

iii) Compute the enthalpy of combustion of the alcohol with six carbon atoms. *(1mark)*

c) i) Using your answer in (ii), calculate the mass of ethanol that when burnt, would release heat energy enough to raise the temperature of $200cm^3$ of water by 20.0^0C. *(2½ marks)*

(Specific heat capacity of water = $4.2Jg^{-1}$ and density of water = $1.0gcm^{-3}$)

ii) State one application of enthalpy of combustion determination. *(1mark)*

END