MUKALAZI

NAME……*STREAM*……*COMB*……

P525/1

CHEMISTRY

Paper 1

August,2025

2hours 15minutes

UGANDA ADVANCED CERTIFICATE OF EDUCATION

CHEMISTRY PAPER 1

INSTRUCTIONS TO CANDIDATES

Answer ALL items in Section A and Section B

ALL questions must be answered in the spaces provided

Mathematical tables(3-figure tables) and adequate or non -programmable scientific calculators may be used

Illustrate your answers with equations where applicable.

Molar gas Constant,R=8.31$JK^{-1}mol^{-1}$

Molar Volume of gas at stp is 22.4litres

(C=12 , H=1, O=16)

For Examiners use only												
1	2	3	4	5	6	7	8	9	10	11	12	**Total**

ITEM 1

Analysis of a sample of substance P proved that it contained 52.2% carbon,13.0% Hydrogen and the rest Oxygen. The researchers were interested in finding the actual formula of P in order to classify it under particular Homologous series depending on the possible isomers generated by its actual formula. When they vaporised 0.1g of P at 157°C and 740mmHg ,it occupied a volume of 78.8cm^3 .To achieve their goal they needed someone to guide them and they have come to you for help.

Task

Use your chemistry knowledge to;

a (i) Help them obtain the actual (molecular) formula of substance P

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(ii) What possible homologous series do the different isomers of P belong to?

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b A group of forensic chemists are investigating organic substances they found at certain suspected illegal chemical dump. analysis gave them the molecular formula of the two compounds as M(C_3H_6)and N (CH_4).To gather more information about the compounds they also need to know the nature of the two compounds and their chemical reactivity.They are aware that you have some knowledge on organic chemistry and have come to you for advice.

As a chemistry student help them to

i)Write the structural formulae and state the functional groups present in the organic compounds.

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ii)Predict the reaction and write the mechanisms for the reaction of

M with hydrogen bromide gas at room temperature.

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M with acidified water

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N with chlorine in presence of UV light

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M with chlorine water

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(iii)Identify the reagent that can be used to distinguish between M and N and state what is observed when the reagent is treated with each of the compounds.

Write the equation for the positive test

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ITEM 2

During the formation of chemical compounds, heat is given out or absorbed from the surrounding. One of the Master students at Makerere University was interested in finding out the amount of heat given out or absorbed when certain fuels like butane are formed from their constituent elements in order to conclude on its stability. On checking in some reference books ,he discovered the fuel value of butane (heat of combustion) was -2877kjmol.He was further provided with the data below;

Heat of formation of carbon dioxide = -393Kjmol

Heat of formation of water = -286Kjmol

Task

a. Explain to him the meaning of standard heat of formation and heat of combustion.

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(ii) Help him to obtain the amount of heat that accompanies the formation of butane and comment on your answer.

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b) The laboratory attendant desired to know the stability of the calcium fluoride that was supplied to his laboratory to be used during the MOCK examination periods.On contacting the supplier ,the data below was provided.

Enthalpy of atomisation energy of Calcium	+193kjmol
Enthalpy of atomisation energy of fluorine	+79Kjmol
Electron affinity of fluorine	-348Kjmol
Enthalpy of formation of calcium fluoride	-1214Kjmol
First ionisation energy of calcium	+590Kjmol
Second ionisation energy of calcium	+1150Kjmol

The supplier further told him that the above data could be used to deduce the lattice energy of calcium fluoride and hence determine the degree of its stability.

Task

a)As a chemistry student explain to him the concept of lattice enthalpy and the factors that determine its magnitude.

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b) By means of born harber cycle deduce the lattice enthalpy and hence comment on the stability

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ITEM 3

In districts like Busia and Buhweju in Uganda, gold, copper, and other metal ores are mined for use in electronics and construction. At the same time, electronic waste (like old phones, computers, and batteries) is piling up in urban centers such as Kampala, posing environmental and health risks.

As part of a national campaign to educate youth on resource management and sustainability, secondary school students are challenged to explore the electronic structures of elements used in electronics, such as copper (Cu), zinc (Zn), chromium (Cr), and iron (Fe).

You are invited to participate in this science challenge by writing electronic configurations and using them to explain the properties and uses of these elements in society.

Task:

a) What is an electronic configuration?

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Explain its significance in understanding the chemical behavior of elements.

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b) Describe the Aufbau principle, Hund's rule, and the Pauli exclusion principle, and how they guide the arrangement of electrons in atomic orbitals.

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c)Write the full electronic configuration and the condensed (noble gas) configuration for the following elements used in Ugandan industries:

i)Copper (Cu), Z = 29

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ii) Zinc(Zn), Z=30

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iii) Iron(Fe),Z=26

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iv) Chromium(Cr),Z=24

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d) Using your configurations above:

Identify the number of unpaired electrons in Fe and Cu.

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e) You are a reasearcher examining the elements Nitrogen(N) and Oxygen (O). Both are in Period 2 of the periodic table and belong to Group 15 and Group 16,respectively .Based on general periodic trends.

As a learner of chemistry;

i)Explain why Nitrogen has a higher first ionisation energy than Oxygen .

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ii)Explain why Oxygen's electron affinity is lower than nitrogen

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ITEM 4

In Uganda hospitals like Mulago National Referral Hospital and Uganda Cancer institute use radioactive isotopes (such as cobalt-60 and iodine -131) in cancer treatment and medical imaging. At the same time, artisanal gold mining areas in districts like Buhweju and Mubende may expose miners and communities to naturally occurring radioactive materials(NORMS) in rock.

To ensure public safety and improve health care, science students are challenged to understand and calculate radioactive decay,

You are one of the students selected to participate in a national science competition to demonstrate your understanding of radioactivity ,its applications and safe use.

Task

a)Define the following terms;

i)Radioactive decay

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ii)Half life

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iii)alpha,beta and gamma

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b)Describe two benefits and two risks of using radioactive isotopes in medicine or mining in Uganda.

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c)Half life calculations;

Iodine -131,used in thyroid cancer treatment has a half life of 8days

i)If a patient is given 20mg ,how much will remain after 24days?

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ii)How many half-lives have passed?

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ITEM 5

Balimunsi and Opoka argue that water,ammonia ,methane ,carbonate ion,sulphate ion and sulphite ion all have similar shapes because they each involve one central atom.

Task

As a chemistry learner;

i)Help them decide the right shapes of those molecules identifying the number of bonding pairs and lone pairs on the central atom.

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