

P525/1

CHEMISTRY

Paper 1

NOV/DEC 2025

2 ¼ hrs

UGANDA ADVANCED CERTIFICATE OF EDUCATION

SENIOR FIVE

END OF TERM III ASSESSMENT 2025

CHEMISTRY

THEORY

TIME: 2hr 15mins

INSTRUCTIONS

- This paper consists of two sections A and B
- Section A has **two compulsory** items
- Section B has two parts; part (I) and part (ii)
- Choose **one** item from each part
- Any additional (s) responded to will **not** be scored

For scorers' only

Item	Score(s)	Scorers' initials
1		
2		
3/ 4		
5/ 6		

SECTION A

ATTEMPT ALL ITEMS IN THIS PART

ITEM 1

In Mukono District, Kals, one of the health officers has reported a rise in high blood pressure linked to excessive consumption of sodium chloride (NaCl), the most common table salt. Nutritionists and chemists are exploring alternative salts, such as potassium chloride (KCl), that are healthier for at-risk communities. However the community needs to know;

- How stable and safe these alternative salts are.
- Whether they will dissolve easily in foods and,
- How much energy is involved in forming and breaking them

Secondary school students are invited to assist in comparing the two salts by analyzing lattice energy, understanding its role in ionic compound stability, and constructing born Haber cycles for each salt.

Step in born Haber cycle	NaCl (KJ/ mol)	KCl (KJ/ mol)
Enthalpy of atomization of sodium and potassium	+107	+89
Ionization energy of sodium and potassium	+496	+419
Bond dissociation enthalpy of chlorine	+244	+244
Electron affinity of formation of salts	-349	-349
Lattice energy	—	—
Enthalpy of formation of salts	-411	-437

Additionally also farmers in Mukono district are using Magnesium Oxide to neutralize their acidic soils so as to improve crop yields. The Uganda Agricultural Research Institute (UARI) is working with local schools to analyze the energy changes involved in producing Magnesium oxide from Magnesium metal and oxygen, to better understand the industrial process and its energy requirements.

Given data

Reaction (process)	Enthalpy change (KJ/ mol)
Sublimation of Magnesium	+148
Ionization of magnesium	+2180
Dissociation of oxygen	+498
Electron affinity of oxygen	-1410
Formation of Magnesium Oxide lattice	Lattice energy= -3900

Task

- a) As a learner of chemistry, write a scientific message you would present to nutritionists and chemists on behalf of your school.

Lined paper template with horizontal ruling lines.

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There is no handwriting or printed text on the paper.

- b) Given that farmers in Mukono apply 3500kg of magnesium oxide per hectare annually to treat acidic soils in Mukono, determine the total energy change associated with the formation of this amount of magnesium oxide.

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ITEM 2

In Jinja, a small factory produces ammonia gas for use in making fertilizers for nearby farms. The factory uses a Haber process, where nitrogen from air combines with hydrogen obtained from water electrolysis,



The reaction is carried out in a sealed, high-pressure container at a certain temperature, with an iron catalyst. One day, the factory manager notices that ammonia production has decreased even though the amount of nitrogen and hydrogen supplied is the same. He suspects that changes in temperature and pressure might have shifted the chemical equilibrium.

The following table shows the percentage of ammonia at equilibrium under different conditions.

Temperature ($^{\circ}\text{C}$)	Pressure(atm)	% Ammonia at Equilibrium
200	200	45
450	200	18
450	100	12
450	300	25

The factory manager targets to get the knowledge about the following;

- ## Task

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SECTION B
ATTEMPT ONLY ONE ITEM IN THIS PART
Part (I)

In Uganda, communities like those in Masaka and Jinja rely on rivers and lakes for water, which often contains impurities, local water treatment initiatives use various chemicals, such as derived from Period 3 elements that is sodium, Magnesium and Aluminum, to purify water for safe consumption. Understanding how these elements react with water is crucial for effective and safe treatment processes. A water treatment project in Masaka District is experimenting with these elements to improve water purification methods. The project leaders want learners to explain the chemical reactions of these elements with water, how these reactions can affect water quality, why the speed of reaction differs and safety precautions to be taken when handling these elements in water treatment.

As one of the learners, make a write-up to explain to project leaders

ITEM 4

In Namanve, a small-scale metal casting workshop makes machine parts for sugar processing factories. The workshop buys bars of Beryllium, Magnesium, Calcium and Barium from different suppliers. During production, the workers heat these metals in a furnace to melt and cast them into shapes. They recorded the temperature at which each metal melted during tests, as shown below

Element	Atomic number(Z)	Melting point($^{\circ}\text{C}$)
Beryllium	4	1287
Magnesium	12	650
Calcium	20	842
Strontium	38	777
Barium	56	725

The workers are puzzled with the observation in trend in melting points of the elements, want to know which metal would be most suitable for making machine parts that must withstand highest furnace temperatures and also seek the graphical representation of melting points against atomic number since their boss wants that representation in the report.

Task

As a chemistry learner, help the workers solve all their problems.

PART (II)**ATTEMPT ANY ONE ITEM FROM THIS PART****ITEM 5**

In Kasese district, a chemical manufacturing company called Kasese Agrochem Ltd produces chlorinated hydrocarbons used in pesticides to support local farmers in tea and coffee plantations. One important industrial reaction is the chlorination of Methane to produce chloromethane, which is a key intermediate.

A team of senior five chemistry students from Kasese high school is invited to study and understand reaction of methane with chlorine under UV light, role of UV light in reaction, how ratio of methane to chlorine can affect selectivity of chloromethane production important for Kasese Agrochem Ltd to optimize yields and reduce waste.

Task

As one of the students, organize a scientific message you would present

ITEM 6

In Hoima district, as part of the oil and gas value addition Initiative, local chemical engineer and chemistry students are working together to design value added products from components of natural gas, such as ethane. One of the high-demand chemicals in detergent and dye production is benzene sulphuric acid, a key material for producing biodegradable cleaning agents and dyes. The team has abundant ethane from nearby oil refinery and needs your help in designing a synthesis path way to produce benzene sulphuric acid.

Task

As a learner, prepare a scientific write-up to present to the local engineers

END

"ORGANISED AND COMPLIED BY PROFESSOR KALS BIOLOGIST"

SUCCESS COMES AFTER STRUGGLE

Merry X-mass and Happy New Year