

Student's Name:.....Signature:

525/1
CHEMISTRY
Paper 1
2025
 $2\frac{1}{2}$ Hours

Oct./Nov, 2025

CHEMISTRY-CONNECT

S5 END OF YEAR ASSESSMENT

Uganda Advanced Certificate of Education

CHEMISTRY

Paper 1

2 Hours and 30 Minutes

INSTRUCTIONS TO STUDENTS:

This paper has two sections A and B.

*Section A has **two** compulsory items while B has two parts **Part I** and **Part II**.*

*Each of part I and II has two items, respond to **ONLY** one from each.*

*Responses to section A and Section B **must** be written in the answer sheets provided. Responses to each item **must** start on the fresh page.*

*Answer **four** items in all.*

FOR EXAMINER'S USE ONLY					
ITEM	1	2	3/4	5/6	TOTAL SCORE
SCORE					

SECTION A

All items in this section are compulsory

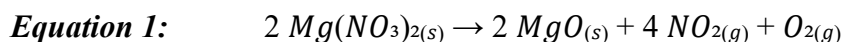
Item 1: Anitah, a S.5 PCM class student at Light Voc SS, wants to make a project of making an electronic cell. She has two ionic salts; Potassium Iodide and Potassium Chloride, one of which she has to choose for use as the electrolyte. It is well known to her that the salt with the higher solubility in water or less stable is more suitable for use in this project. However, she is confused of which one of the two. When she consulted the chemistry teacher for advice, she was given the following enthalpy data in table 1 to use for self direction. But she failed to know how to use it and she needs your help.

Enthalpy description	Enthalpy value (KJ/mol)	Enthalpy description	Enthalpy value (KJ/mol)
Formation of potassium iodide	-327.9	First ionization of potassium	+419
Formation of Potassium Chloride	-436.7	Bond dissociation of Iodine	+151
Hydration of potassium Iodide	-628	First electron affinity of Iodine	-295
Hydration of potassium Chloride	-685	First electron affinity for Chlorine	-349
Sublimation of potassium	+89	Bond dissociation energy of Chlorine	+242.3

Task: As her fellow chemistry student, Help Anitah to;

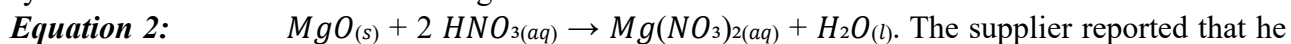
- Analyze the data she has to construct a suitable energy diagram to determine the lattice energy of each electrolyte.
- Identify the more suitable electrolyte for use in her project basing on stability. State a reason for your suggested choice.
- Know the enthalpy of solution for each electrolyte. Using born Haber cycles.
- Comment on the results and recommend Anitah on which salt she should use for her project.

Item 2: AgroTech Minerals Ltd. has developed a new inorganic fertilizer labeled X in Hydrated Form. Laboratory analysis shows that the solid contains 9.37% magnesium, 10.93% nitrogen, and 42.18% water of crystallization and rest being oxygen. Molar mass of X is 256g. 5.0 kg of the fertilizer was available for sale, the manager sought to know the amount in mass of nitrate nutrient in X that would be delivered to maize. Keen to know about environmental hazards, X was burnt in absence of air and decomposed with brown gas of nitrogen dioxide according to equation:



The company sought to know the volume at s.t.p of the brown gas produced from burning 1.0 kg of the fertilizer and assess the environmental impacts of the emissions and mitigations.

Due to available rocks containing magnesium in the area, the company manager further seeks to evaluate the industrial synthesis of the fertilizer X from magnesium oxide:



would potentially supply 10.0 kg of magnesium oxide per day, and the manager intends to know how much fertilizer would be available in one month and also possible environmental impacts of using the fertilizer and mitigations.

Task: As a learner of Chemistry, help the company to know;

- The Molecular formula of compound X.

- b) Mass of nitrate nutrient in X that would be delivered to maize.
- c) (i) The volume at s.t.p of the brown gas produced from burning the fertilizer.
(ii) The environmental impacts of the brown gas emissions and mitigations.
- d) (i) Mass of the fertilizer produced in one month.
(ii) Possible environmental impacts of using the fertilizer and their mitigations

SECTION B

Part 1

Choose only one item from this part.

ITEM 3

You are a researcher studying the properties of group 14 oxides (CO_2 , SiO_2 , GeO_2 , SnO_2 , PbO_2). You are tasked with investigating their reactions with acids, bases, and water, and exploring their applications in various industries in Uganda.

These oxides of group 14 elements exhibit diverse chemical properties and have numerous applications.

TASK

- a) Describe the reactions of CO_2 and SiO_2 with:
- i) Sodium hydroxide (NaOH)
ii) Hydrochloric acid (HCl)
- b) Compare the melting points of CO_2 and SiO_2 . How does this difference affect their uses?
- c) Explain why PbO_2 is used in lead-acid batteries, considering its reaction with sulfuric acid (H_2SO_4).
- d) Give one example of a daily life application of SiO_2 , utilizing its resistance to acids and bases.
- e) How do the oxides of group 14 elements contribute to environmental pollution? Provide one example.

ITEM 4: A manufacturing company in Mukono produces parts for high temperatures furnaces and electrical systems. The durability of each component depends on the melting point of the material; higher melting points ensure better heat resistance and mechanical strength. To guide the selection, a team of researchers compared melting points of selected group II and period 3 elements.

The following data was available

Group/ period	Group II					Period 3							
Element	Be	Mg	Ca	Sr	Ba	Na	Mg	Al	Si	P	S	Cl	Ar
Atomic number	4	12	20	38	56	11	12	13	14	15	16	17	18
Melting point ($^{\circ}\text{C}$)	1280	650	850	770	720	97.8	650	660.3	1414	44.2	115.2	-101.5	-189.4

The engineering department seeks a scientific analysis to select materials for different temperature ranges. The company is also considering an unknown X, positioned between aluminium and silicon in the periodic table.

Plotting graphs of melting point against atomic number for group II and period 3 (separately), helps to describe and explain trends and irregularities in the melting points across period 3 and group II. evaluating with reasons the most suitable element(s) for furnace lining and electrical connectors and predicting the likely melting point range and industrial suitability of the unknown element X was also key.

Task;

As a chemistry student, make a write up you will use to help the company.

Part II

Choose one item from this Part

ITEM 5: A chemical research laboratory in Uganda is studying a gaseous hydrocarbon X obtained from a petrochemical source.

Elemental analysis shows that X contains 11.11 % hydrogen by mass, and its vapour density is 27, giving a relative molecular mass of 54.

When 1 mol of X reacts with 1 mol of hydrogen over a nickel catalyst at 150 °C, the product still contains a carbon–carbon double bond.

This compound also reacts readily with bromine and hydrogen chloride, forming useful addition products.

The laboratory wishes to identify X, investigate its reactions, and highlight safe handling and environmental precautions when working with gaseous hydrocarbons.

Task: As a Chemistry student, help the laboratory by showing:

- (a) Determine the molecular formula of X and state its class of hydrocarbons.
- (b) Draw and name all structural isomers of X.
- (c) Using equations, describe two key addition reactions of the alkene product of X:
 - (i) Reaction with bromine.
 - (ii) Reaction with hydrogen chloride.
- (d) Outline the mechanism for one of these addition reactions, clearly showing how the product is formed.
- (e) State two dangers of handling gaseous hydrocarbons and give one mitigation for each.

ITEM 6: At Kampala Polymer works, engineers manufacture plastic bottles from the hydrocarbon (ethene gas). A recent system fault allowed bromine vapour and hydrogen chloride to enter the polymerization chamber, producing brittle, coloured plastics instead of clear ones. The management consults A-level chemistry learners to determine the chemical cause and how to prevent recurrence.

Task: As a chemistry learner,

- a) Explain why the hydrocarbon mentioned reacts readily with bromine and hydrogen chloride.
- b) State the observation confirming the reaction between the hydrocarbon and bromine.
- c) Write the chemical equation and outline the mechanism for the reaction between the hydrocarbon with bromine and hydrogen chloride.
- d) Suggest technical adjustments that would restore correct polymer production.

END

“Enjoy the beauty of Chemistry”