

Name: ..... Combination.....Sign.....

**P525/1**

**Chemistry (Theory)**

**Paper 1**

**2½ hours**

# R W E N Z O R I H I G H S C H O O L

**Uganda Advanced Certificate of Education**

**End of term two assessment 2025**

**S5 Chemistry P525/1**

**Paper 1**

**Time: 150 Minutes**

## **INSTRUCTIONS:**

- Attempt **all** items in **section A** and **section B**
- Answers in **section A** should be written in spaces provided.
- Answers to **section B** should be written on answer sheets provided.
- You are allowed access to a periodic table and a silent non-programmable calculator.
- Neatly and logically present your responses, avoid rough work, make well labeled illustrations where necessary.

## SECTION A:

### Item 1

Residents in a rural community have reported that their tap water has an unusual taste. Some people have also started experiencing minor health issues, such as nausea and fatigue. Local authorities suspect contamination from abandoned electronics recycling facility nearby, where heavy metals like Cadmium (Cd), Lead (Pb), Iron (Fe), Magnesium (Mg), and Zinc (Zn) and their compounds were once used.

Water samples were collected and sent to a lab for analysis using Mass Spectrometry; a technique used to detect trace amounts of metal ions in water, however, they could not tell which metal was present. The following data was collected for the metallic element found:

Isotope	Relative isotopic mass	Relative abundance(%)
$X_1$	23.985	78.99
$X_2$	24.985	10.00
$X_3$	25.983	11.01

#### Task;

- (a) Using the knowledge of chemistry you have obtained, explain the mode of operation of the instrument used in the chemical analysis.

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(b) By mathematical analysis, interpret the data recorded above and identify the element found in the contaminated water.

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(c) Suggest the reasons why the analytical technique used is suitable for analyzing environmental samples like groundwater.

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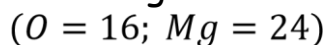


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**Item 2**

A local factory uses magnesium metal to produce magnesium oxide, which is then used in the production of fire-resistant materials. The factory has a target of producing a minimum of 8 kg of magnesium oxide on a daily basis. The supplier is able to supply only 5 kilograms of magnesium per day.

Magnesium burns in air to produce magnesium oxide.



The factory manager is not well versed with application of moles and equations and wants to know if their daily target is achievable using the daily available amount of magnesium metal.

**Task:**

Guide the factory manager to know if his daily target is achievable, assuming complete reaction and no loss of material.

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**SECTION B;**

**Attempt all items on answer sheets provided**

**Item 3**

You are working in the analytical chemistry section of a forensic science laboratory. Investigators recovered a liquid organic sample labelled compound Q from the scene of explosion. They suspect it's a volatile hydrocarbon derivative possibly an alcohol or ether used to ignite fire. To identify the compound, you perform a combustion experiment where the different data was obtained. 3.70g of compound Q with molar mass of 74g obtained from the tin was completely burnt in excess oxygen and it produced 4.50g of water and 6.48dm<sup>3</sup> gaseous mixture. The gaseous mixture was then passed through concentrated potassium hydroxide solution and the volume decreased to 2.0dm<sup>3</sup>.

**Task:**

As a chemistry student, you are required to determine the structural formula of compound Q and its possible isomers with their corresponding names that might have been picked from the scene.

#### Item 4

Nitrogen monoxide, NO, is a pollutant gas which comes out of every vehicle exhaust. One technique for reducing the quantity of nitrogen monoxide in vehicle exhausts is to inject a stream of ammonia, NH<sub>3</sub>, into harmless products nitrogen and water:



An average vehicle emits 5g of nitrogen monoxide per mile. Assuming a mileage of 10000 miles a year, what mass of ammonia would be needed to clean up the exhaust?

#### Item 5

A company specializes in producing fuel additives for a camping stove fuel. They are considering using a compound with molecular formula C<sub>5</sub>H<sub>12</sub> as part of their additive formulation.

However, on doing research they found out that the compound has different isomers, with different physical properties but similar chemical properties.

The company wants to know which isomer would be better for their fuel mixture basing on boiling point. The best fuel additive should be one that has the lowest boiling point. All isomers work for the application, but one is more suitable due to its physical and chemical properties.

#### Task:

Write a message ;

(a) enlighting the company on the different isomers, any similar chemical property they exhibit.

(b) advising and explaining to them on which isomer would be best suited for their fuel additive formulation.

**#END#**